

The Town of South Hadley, Massachusetts



2016 Hazard Mitigation Plan Update

Mission

To reduce or eliminate the loss of life, property and government disruption to all natural hazards.

2016 Hazard Mitigation Plan Update

Prepared by:

South Hadley Hazard Mitigation Planning Committee



The Pioneer Valley Planning Commission

60 Congress Street First Floor
Springfield MA 01104
(413) 781-6045
www.pvpc.org

JAMIE CAPLAN CONSULTING LLC
Emergency Management Services

Jamie Caplan Consulting LLC
351 Pleasant Street, Suite B #208
Northampton, MA 01060
(413) 586-0867
www.jamiecaplan.com

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ACKNOWLEDGEMENTS

SOUTH HADLEY HAZARD MITIGATION COMMITTEE

Mark Aiken, Water Superintendent, District 2

Scott Brady, Fire Captain, District 2

Todd Calkins, Assistant Chief, Fire District 2

Jeff Cyr, Water Superintendent, District 1

Erica Faginski, Director of Curriculum & Grants, School Department

Richard Harris, Town Planner

Sharon Hart, Emergency Management Director

Jason Houle, Lieutenant, Fire District 1

David Keefe, Fire Chief, Fire District 2

David LaBrie, Police Chief

Bruce Mailhott, Facilities Director, School Department

Andy Orr, Engineer, South Hadley Electric Light Department

Alec Plotnikiewicz, Intern, Fire District 1

Jim Reidy, Supervisor, Department of Public Works

Janice Stone, Conservation Commission

The South Hadley Selectboard offers thanks to the Massachusetts Emergency Management Agency (MEMA) for developing the Commonwealth of Massachusetts 2013 State Hazard Mitigation Plan which served as a model for this plan.



CERTIFICATE OF ADOPTION
TOWN OF SOUTH HADLEY, MASSACHUSETTS
BOARD OF SELECTMEN
A RESOLUTION ADOPTING THE
TOWN OF SOUTH HADLEY 2016 HAZARD MITIGATION PLAN UPDATE

WHEREAS, the Town of South Hadley established a Committee to prepare the **2016 Hazard Mitigation Plan Update**; and

WHEREAS, the Town of South Hadley participated in the development of the Town of South Hadley **2016 Hazard Mitigation Plan Update**;

and WHEREAS, the Town of South Hadley **2016 Hazard Mitigation Plan Update** contains several potential future projects to mitigate potential impacts from natural hazards in the Town of South Hadley, and

WHEREAS, a duly-noticed public meeting was held by the Board of Selectmen on _____ for the public and municipality to review prior to consideration of this resolution; and

WHEREAS, the Town of South Hadley authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of South Hadley Board of Selectmen formally approves and adopts the Town of South Hadley **2016 Hazard Mitigation Plan Update**, in accordance with M.G.L. c. 40.

ADOPTED AND SIGNED this

ATTEST

LIST OF ACRONYMS

Ag Com	Agricultural Commission
BOS	Board of Selectmen
CEM Plan	Comprehensive Emergency Management Plan
CIS	Community Information System
CIS	Community Information System
Con Com	Conservation Commission
CRS	Community Rating System
DCR	Massachusetts Department of Conservation and Recreation
DEP	Massachusetts Department of Environmental Protection
DPW	Department of Public Works
EMA	Emergency Management Agency
EMD	Emergency Management Director
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance Program
GIS	Geographic Information System
HAZMAT	Hazardous Materials
HMGP	Hazard Mitigation Grant Program
LEPC	Local Emergency Planning Committee
MassGIS	Office of Geographic Information
MDC	Metropolitan District Commission
MEMA	Massachusetts Emergency Management Agency
MOU	Memorandum of Understanding
MPH	Miles Per Hour
MSDS	Material Safety Data Sheets
NECIA	Northeast Climate Impacts Assessment
NESIS	Northeast Snowfall Impact Scale
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NTNC	Non-transient non-community
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PVPC	Pioneer Valley Planning Commission
RACES	Radio Amateur Civil Emergency Service
SFHA	Special Flood Hazard Area
TNC	Transient non-community
TRI	Toxics Release Inventory
USGS	United States Geological Survey
WHRHSAC	Western Region Homeland Security Advisory Council
WMECO	Western Massachusetts Electric Company

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PLANNING PROCESS

INTRODUCTION

The Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA) define natural hazard mitigation as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards such as flooding, storms, high winds, hurricanes, wildfires, earthquakes, and similar occurrences. Mitigation efforts undertaken by communities help minimize damages to public buildings and infrastructure, such as water supplies, sewers and utility transmission lines, as well as private property and natural, cultural and historic resources.

Pre-disaster mitigation planning, including this effort by the Town of South Hadley and the Pioneer Valley Planning Commission, is a proactive process. Pre-disaster planning emphasizes actions that can be taken before a natural disaster occurs. Future property damage and loss of life can be reduced or prevented by a mitigation program that adequately addresses the unique geography, demography, economy, and land use of a community within the context of each of the specific potential natural hazards that may threaten a community.

Preparing, and updating every five years, a local natural hazards mitigation plan before a disaster happens can save the community money and will facilitate post-disaster funding. Costly repairs or replacement of buildings and infrastructure, as well as the high cost of providing emergency services and rescue/recovery operations, can be avoided or significantly lessened if a community implements the mitigation measures detailed in the Plan. FEMA requires that a community adopt a pre-disaster mitigation plan as a condition for mitigation funding. For example, the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), and the Pre-Disaster Mitigation Program are programs with this requirement.

PLANNING PROCESS

In 2016, the Town of South Hadley completed an update of their 2007 Local Natural Hazards Mitigation Plan, in collaboration with the Pioneer Valley Planning Commission. All portions of the plan were reviewed and updated as necessary. Planning for hazard mitigation in South Hadley involved a Hazard Mitigation Committee comprised of representatives from the Town of South Hadley, both fire and water districts and the School Department.

- Mark Aiken, Water Superintendent, District 2
- Scott Brady, Fire Captain, District 2
- Todd Calkins, Assistant Chief, Fire District 2
- Jeff Cyr, Water Superintendent, District 1
- Erica Faginski, Director of Curriculum & Grants, School Department
- Richard Harris, Town Planner
- Sharon Hart, Emergency Management Director
- Jason Houle, Lieutenant, Fire District 1
- Davide Keefe, Fire Chief, Fire District 2

- David LaBrie, Police Chief
- Bruce Mailhott, Facilities Director, School Department
- Andy Orr, Engineer, South Hadley Electric Light Department
- Alec Plotnikiewicz, Intern, Fire District 1
- Jim Reidy, Supervisor, Department of Public Works
- Janice Stone, Conservation Commission

The hazard mitigation planning process for the Town included the following tasks:

- Reviewing and incorporating existing plans and other information.
- Identifying the natural hazards that may impact the community.
- Conducting a Vulnerability/Risk Assessment to identify the infrastructure at the highest risk for being damaged by the identified natural hazards, particularly flooding.
- Identifying and assessing the policies, programs, and regulations the community is currently implementing to protect against future disaster damages.
- Identifying deficiencies in the current strategies and establishing goals for updating, revising or adopting new strategies.
- Adopting and implementing the final 2016 Hazard Mitigation Plan Update.

The key product of this process is the development of an Action Plan with a Prioritized Implementation Schedule.

The planning process began with a meeting on January 13, 2016 between Richard Harris, South Hadley Town Planner, Sharon Hart, South Hadley Emergency Management Director and Jamie Caplan, Jamie Caplan Consulting LLC. Ms. Caplan was hired by the Pioneer Valley Planning Commission to assist them and the Town of South Hadley with the planning process.

During this meeting, Ms. Caplan reviewed the mitigation planning process with Mr. Harris and Ms. Hart. The three brainstormed a list of potential Hazard Mitigation Committee members and outlined potential meeting dates for the Hazard Mitigation Committee. They also spoke about the need for two public meetings and identified potential dates for those as well.

Hazard Mitigation Committee Meetings

Meetings of the Hazard Mitigation Planning Committee, all of which took place at the South Hadley Town Hall, were held on the dates listed below. Sign-in sheets for each meeting are included in Appendix B. While not all members of the Hazard Mitigation Committee were able to attend each meeting, all members collaborated on the plan and were updated on progress by fellow Committee members after meetings occurred as necessary.

January 20, 2016

The Hazard Mitigation Committee reviewed a PowerPoint presentation that emphasized the planning process, discussed the list of hazards to consider and reviewed the old list of critical facilities. In terms of hazards the Committee decided to add landslide to the list. They don't have steep slope areas except at the landfill. A brief discussion revealed a concern that a landslide could impact a building and wetlands at the landfill. The Committee discussed multiple changes to the 2007 critical facility list. They will review an updated list at their meeting the following week. They also reviewed the mitigation goal statement and agreed with the consultant's suggestion to remove the list of natural hazards and list natural hazards in general because that seems more inclusive.

January 28, 2016

During this meeting, the Hazard Mitigation Committee reviewed the updated list of critical facilities. They removed recreation areas and added town buildings. They also removed the category system from the previous plan because it caused confusion. The meeting then turned to a review of the list of mitigation actions from the previous plan. The majority of those actions were implemented and the Committee began to discuss additional mitigation actions. Both the discussion about critical facilities and the one about mitigation actions included the relationship between the town and Mount Holyoke College. The Committee agreed that communication between the two entities is advantageous.

February 3, 2016

The Hazard Mitigation Committee reviewed an updated list of mitigation actions during this meeting. They also brainstormed some additional mitigation actions that can be added to the plan. In addition, outreach for the first public meeting was discussed as well as a presentation agenda for the public meeting.

February 18, 2016

The Hazard Mitigation Committee reviewed the complete list of hazard mitigation actions. They attached an estimated cost to each as well as an estimated start and end date. In addition, they identified the responsible departments or agency for implementing the mitigation action and potential funding sources. After that, they reviewed the entire list and ranked them in order of priority. For more information on this process and to see the final ranking, see the Mitigation Strategy chapter of this plan.

March 10, 2015

The Hazard Mitigation Committee reviewed the draft plan at this meeting. They focused their time on the hazard ranking tables as well as a discussion about purchasing generators for critical facilities. It was determined at this meeting to put a mitigation action in the plan that includes purchasing generators for the backup EOC, the Town Hall, the Middle School and Mosier School. The Committee discussed the timeline and plan for making the 2016 Hazard Mitigation Plan Update available to the public for their review.

Participation by the Public and Neighboring Communities

Two public meetings were held as part of the mitigation planning process – on February 10, 2016 and March 7, 2016. Public meeting outreach materials and notices can be found in Appendix B.

Both meetings occurred after the Hazard Mitigation Committee had provided input on hazards and mitigation strategies relevant to the community. A flyer and press release were developed prior to each meeting. Notice of both public meetings was posted in the Town Hall in compliance with the Commonwealth of Massachusetts' open meeting law.

The press release was posted on the PVPC website, and sent to the following media outlets, WWLP, Hampshire Gazette, WGGY, Channel 15 and the Town Reminder. The flyer was posted at the Public Library, the Senior Center and the Town Hall. The Town Administrator forwarded the flyer to the Selectboard. Each Hazard Mitigation Committee member shared the outreach materials with their coworkers. The media outreach served to invite members of adjacent communities to participate in the South Hadley mitigation planning process.

February 10, 2016 Public Meeting

Twenty-one people attended the first public meeting, held in conjunction with the Planning Board meeting on February 10, 2016. The majority of the Hazard Mitigation Committee was in attendance as well as several Planning Board members and a couple of people from the public. The level of interest shown by the Planning Board members and the public was high. Ms. Caplan delivered a PowerPoint presentation that included basic information regarding hazard mitigation planning, a participatory exercise and an overview of the South Hadley 2016 Mitigation Plan Update. Participation was high and questions were asked.

March 8, 2016 Public Meeting

XX number of people attended the second public meeting, held in conjunction with a Selectboard meeting on March 8, 2016. The majority of the Hazard Mitigation Committee. Ms. Caplan gave a presentation that included an overview of the planning process and an emphasis on the mitigation actions identified. Several members of the Selectboard as well as residents asked questions. The questions included information regarding funding for mitigation projects, how to determine the value or benefit/cost of mitigation projects and the adoption process. Enthusiasm for the project was evident.

Participation by Additional Stakeholders

A variety of stakeholders were provided with an opportunity to be involved in the development of the 2016 Hazard Mitigation Plan Update. The different categories of stakeholders that were involved, and the engagement activities that occurred, are described below.

Local and Regional Agencies

The Pioneer Valley Planning Commission (PVPC) is a regional planning agency for forty-three towns and cities in Massachusetts' Hampden and Hampshire Counties. PVPC regularly engages

with the Town of South Hadley as part of its regional planning efforts, which include the following:

- Developing the Pioneer Valley Regional Land Use Plan, Valley Vision 2, which advocates for sustainable land use throughout the region and consideration for the impact of flooding and other natural hazards on development.
- Developing the Pioneer Valley Climate Action and Clean Energy Plan, which assesses the impact that climate change will have on the region and recommends strategies for mitigation that can be implemented by local municipalities and businesses.
- Collaborating with state agencies, such as the Department of Conservation and Recreation, to maintain inventories of critical infrastructure throughout the region.

All of these PVPC initiatives considered the impact of natural hazards on the region and strategies for reducing their impact to people and property through hazard mitigation activities. The facilitation of the South Hadley 2016 Hazard Mitigation Plan Update by PVPC ensured that the information from these plans was incorporated into the Hazard Mitigation Planning process.

In addition, the PVPC is actively involved in the Western Region Homeland Security Advisory Council (WRHSAC). WRHSAC, which includes representatives from Western Massachusetts municipalities, Fire Departments, Public Works Departments, Police Departments, area hospitals and regional transit from throughout the four counties of western Massachusetts, is responsible for allocating emergency preparedness funding from the US Department of Homeland Security. The representatives of these disciplines who serve on the WRHSAC are charged with sharing the information discussed at meetings with their colleagues at their regular meetings. PVPC attends all WRHSAC meetings and all WRHSAC members are aware of the fact that Ware was updating its Hazard Mitigation plan. Meetings of WRHSAC regularly involve discussion about how to improve emergency preparedness in western Massachusetts, and hazard mitigation activities are included in this discussion.

For the update of this Hazard Mitigation Plan, PVPC provided feedback from WRHSAC on regional mitigation activities and natural hazards pertaining to South Hadley. This was the method through which WRHSAC was engaged in the planning process.

In addition, PVPC staff regularly present to their Executive Committee and Commission (representatives from the 43 cities and towns that comprise the Pioneer Valley, when new projects are launched and when funding opportunities are available). As result, all the communities in the region were informed of South Hadley's 2016 Hazard Mitigation Plan Update process and encouraged to comment.

PVPC staff included a summary article on the status of Hazard Mitigation planning in the region in the quarterly Regional Reporter that is mailed to area Chambers of Commerce, all member municipalities, area colleges and universities and other key stakeholders in the region. In this way, businesses, educational institutions and other key stakeholders were educated about and informed of Ware's hazard mitigation planning work.

Draft Plan Review

Citizens from adjacent municipalities were encouraged to comment on South Hadley's plan.

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. The Hazard Mitigation Committee will hold all meetings in accordance with Massachusetts open meeting laws.

Plan Adoption

In 2013, the Select Board agreed to begin the process of updating the Town's 2007 Hazard Mitigation Plan. Once the plan was provisionally approved by FEMA, the Select Board held a public hearing on the plan and adopted it on _____.

AUTHORITY AND ASSURANCES

The Town of South Hadley will continue to comply with all applicable federal laws and regulations during the periods for which it receives grant funding in compliance with 44 CFR 201.6 and will amend its plan whenever necessary to reflect changes in Town, State or Federal laws and regulations as required in 44 CFR 201.6.

LOCAL PROFILE

COMMUNITY SETTING

The Town of South Hadley is a richly diverse community that includes a diverse range of housing, farms, light industry and a nationally renowned college. Situated along the east bank of the Connecticut River in proximity to the Holyoke Dam and along the southern ridge of the Mount Holyoke Range, the Town's natural resources and access to the regional transportation network have enabled the Town to grow and develop. In particular, the Town's proximity to the major cities of Springfield, Holyoke and Chicopee has contributed to its growth and vitality. Historically, the Town has had two dominant centers – the area around Mount Holyoke College including the Village Commons and the South Hadley Falls neighborhood. The Village Commons is a popular commercial district near Mount Holyoke College while South Hadley Falls is situated at the southwestern portion of the Town adjacent to the Connecticut River/Holyoke Dam and is a major center of employment and the densest residential development in Town.

The Town of South Hadley is located in Hampshire County, just north of the City of Chicopee. South Hadley is located along the east bank of the Connecticut River, south of Hadley and directly west of Granby. The town consists of moderate slopes with elevations ranging from 250 feet above sea level to over 1000 feet in the northern portion of town in the largely undeveloped and natural Mount Holyoke Range.

According to the 1999 MacConnell Land Use Data, the total land area of South Hadley is approximately 11,816 acres with roughly 26 percent of those acres as developed land. The remaining land is classified as undeveloped. Forest lands represent the largest portion of the undeveloped land, 5,688 acres, that accounts for nearly half of all land in South Hadley. Cropland is the second largest category of undeveloped land with 888 acres compared to pastureland, which represents the third greatest amount of undeveloped land in the town with 310 acres.

Schools

South Hadley has educational institutions at all levels of the educational scale. These institutions are: The Pioneer Valley Performing Arts Charter Public School, South Hadley High School, Michael E. Smith Middle School, Mosier School and Plains School. Also, Mount Holyoke College houses a population of more than 2,000 students and draws young women between the ages of 18-22 on a national and international scale.

INFRASTRUCTURE

Historically, the working landscapes of South Hadley have shaped the physical, economic, and cultural character of the community. The old mill buildings, forests and remaining farms continue to contribute to the economic and environmental well-being of the town.

Roads and Highways

South Hadley is connected to surrounding communities via four main arteries, Route 33, Route 47, Route 116 and Route 202. Route 116 runs north-to-south through South Hadley from Holyoke to Granby and Amherst. Route 202 runs southwest-to-northwest through town from Holyoke to Granby and adjacent communities. Both Routes 116 and 202 rely on bridge crossings into Holyoke for external links to surrounding communities with 116 relying on the County Bridge and 202 relying on the Mueller Bridge. Secondary, but major, routes branch off of Route 116 to provide linkages to the north and south. Route 47 branches off of Route 116 in the center of town and travels north, over the Mount Holyoke Range, to Hadley (leading to Route 9 and connections to Northampton). Route 33 branches off of Route 116 at the intersection of Route 116 and Lyman street and travels south to Chicopee (and leads to the MassPike – Interstate 90).

Public Transportation

The Pioneer Valley Transit Authority operates four routes in South Hadley. However, only the Tiger Trolley route is focused on providing service through and within the Town as evidenced by the descriptions of the services.

The Tiger Trolley provides the most extensive local service within the Town. Its designated route takes it to the Main public library, the Town Hall/Police Station complex, the Big Y plaza on Willimansett Street, the former Big Y area, and the Village Commons. It is flexible in its route with the ability to deviate which allows riders to access the Raymond Center on Route 202, the Senior Center off Newton Street, Lathrop Village off Lathrop Street, and the United Methodist Church in the Falls. Service is generally limited to 8 trips between 7:00 a.m. to 7:00 p.m. on weekdays exclusive of holidays.

Red 29 route provides access from Mount Holyoke College to Holyoke and Springfield. Service is provided 7 times each weekday generally between 7:00 a.m. and 10:00 p.m. More limited service is provided on weekends. The only stop in South Hadley for this route is Mount Holyoke College. A bus shelter at Mount Holyoke College is also a stopping point for several other bus routes serving Amherst and Northampton – the five Colleges.

Route 38 runs from and connects Mount Holyoke College to UMass (as well as Amherst College and Hampshire College) in Amherst. Service is provided approximately every 30 minutes from 7:00 a.m. until almost midnight on weekdays. However, service varies for particular days, weekends, and during winter. This service also offers the opportunity to connect to Smith College, Atkins Farm, and the Notch Visitor Center as well as other locations in the communities of Amherst, Hadley, and Northampton.

Route 39 offers a loop service connecting Mount Holyoke College to Hampshire College and Smith College. Similar to Route 38 in its purpose and function, this route Service is provided approximately every 30 minutes from 7:00 a.m. until almost midnight on weekdays. However, service varies for weekends and during winter. This service also offers the opportunity to connect to UMass in Amherst via a connection to Route 38.

Public Drinking Water Supply

Fire protection and municipal water service is provided throughout South Hadley by the two independent Fire Districts and their water departments. The northern half of the Town lies in Fire District #2 and receives its drinking water from the District's wells located off Sullivan Lane. Two surface water sources were abandoned in 2002 and, since then, South Hadley has not used any surface water sources for its drinking water needs. Fire District #1 receives water from its connection to the Metropolitan District Commission's (MDC) Quabbin Reservoir along with several other local communities. The two independent districts have seven interconnections which allow them to feed each other during an emergency.

Sewer Service

South Hadley currently operates a wastewater treatment plant that serves approximately 6,700 households, including 289 in Chicopee and 328 in Granby. Additionally, over 200 commercial and industrial customers in South Hadley and several in Granby are served by the plant. An average of 2.3 million gallons of raw sewage is treated daily. Although most of the Town is serviced by the public sewer system, nearly all of the area north of Bachelor Brook is handled by private septic systems. This is largely due to the prohibitive cost of installing sewer infrastructure along the changing topography in the northern areas at the foot of the Mt. Holyoke Range. The installation of a 30-inch sewer trunk line along the Connecticut River in 1976 resulted in the expanded residential development of the Alvord Street corridor in an area of prime farmland.

NATURAL RESOURCES

The following information in the Natural Resources section was excerpted from the South Hadley Master Plan (2010) or drew from the town website for facts and information.

South Hadley's landscape varies from the steep, forested mountainsides of the Mount Holyoke Range to the broad, flat alluvial floodplains of the Connecticut River. These two resources have shaped the growth of South Hadley from its founding in 1753 to the present day. In the earliest years of settlement, farming and forestry provided residents with income and nourishment. As time wore on and the industrial revolution flourished, the town embraced many new technologies that capitalized on the Connecticut River's vast reserved of unused potential and kinetic energy. Construction of the South Hadley Canal facilitated development of an industrial sector in the South Hadley Falls neighborhood of Canal Village area of the Town. Industry has since retreated from its peak, but the roads and ways and neighborhoods that grew and developed as the town shifted, expanded and changed still guide and direct residential growth and development in town.

Water Resources

South Hadley's water resources include the rivers, brooks and streams, extensive wetlands, and several ponds. The abundance of water resources is also reflected in the reliable availability of groundwater for municipal water supplies.

Lakes and Ponds

There are seven lakes and ponds in South Hadley including:

1. Upper Pond
2. Lower Pond
3. Lithia Springs
4. Black Stevens Pond
5. Hillcrest Pond
6. Titus Pond
7. Leaping Well Reservoir

Many other smaller bodies of water are scattered across the landscape of South Hadley primarily located along streams and in wooded areas. Most of the 452 acres of open water in South Hadley are comprised of these small ponds and lakes. These water bodies offer valuable wildlife habitat, unique natural environments, and provide benefits to South Hadley's human inhabitants in the form of prime recreational opportunities and water supply.

Rivers and Streams

South Hadley lies entirely within the Connecticut River Watershed. Most of the Town's drainage stays within Town boundaries before emptying into the Connecticut River. South Hadley has six major streams. The tributaries and watersheds of Bachelor Brook, Buttery Brook, and Stony Brook which flow westward into the Connecticut River are the best-known in Town. Contributing to these larger streams are Leaping Well Brook, Elmer Brook, Judd Brook, White Brook, and Dry Brook.

There are 1,973 acres of land within Office of Geographic Information (MassGIS) riparian corridors in South Hadley. There are 1,571.4 acres of land in town within the 200-foot. Rivers Protection Buffer Area and 828.5 acres of land in the 100-foot river buffer. The Rivers Protection Act protects the significant rivers and streams in South Hadley. The Rivers Protection Act offers additional protection of lands in the area within 200-feet of the mean high water mark of a perennial stream or river. Development within this 200-foot riverfront area requires proof that there is "no practicable or substantially equivalent economic alternative" with less adverse impacts. South Hadley currently does not have a local rivers protection bylaw. Riparian areas are those vegetated lands adjacent to streams and rivers. This juncture of land and water attracts a range of species and tends to mark a transition zone between habitats. As such, these corridors link one habitat to another.

The value in maintaining vegetative cover and uninterrupted riparian corridors goes beyond wildlife preservation. These corridors and wetlands provide many other significant public health benefits for the entire community. These benefits include:

- Flood mitigation for agricultural crops and structures by storing and slowing runoff;
- Water supply protection, through filtration of pollutants. (Studies by the Environmental Protection Agency show that over 75% of phosphorus and nitrogen can be filtered in riparian areas adjacent to farmland)
- Erosion control by absorbing and slowing down storm runoff, these storage areas reduce erosion that results from fast flowing water;

- Groundwater replenishment;
- Stormwater management and regulation of water levels in watersheds;
- Open space corridors and recreational opportunities, such as fishing, boating, and hunting.

Wetlands

There are approximately 97.2 acres of wetlands in South Hadley. Wetland habitats in town occur primarily along the streams and rivers as well as in lands adjacent to the major ponds in South Hadley. If open waters are included in this accounting, the total acreage of wetlands in South Hadley rises to 549.1 acres. These wetlands and flood areas are shown on South Hadley's Water Resources Map, which is included in the Map Appendix. Development of wetland areas in South Hadley is limited by the Massachusetts Wetlands Protection Act.

In November 2005, South Hadley Town Meeting adopted a local Wetlands Bylaw which provides more significant protection for wetlands and wetland buffer zones than afforded by the Massachusetts Wetlands Protection Act. The local bylaw provides additional protection for vernal pools, intermittent streams and the buffer zone. It includes a 50 Foot Conservation (or non disturbance) zone. The bylaw allows some exemptions for minor activities and four reasons for a possible waiver, including for public safety, handicapped accessibility, and community enhancement. The Attorney General Office subsequently approved the Bylaw and in 2011, the Conservation Commission enacted Rules & Regulations providing for administrative procedures for its implementation and administration.

Wetlands are areas that contain surface water or have high ground water for all or some part of the growing season. In Massachusetts, inland wetland resource areas include rivers and streams, lakes and ponds, swamps, wet meadows, bogs, beaver ponds, vernal pools, and land within the FEMA-defined 100-year flood area. Massachusetts also protects Riverfront Area, defined as the area extending out 200-feet horizontally from the banks of perennial streams and rivers. Wetlands, including water bodies, are home to amphibians, fish, mollusks, reptiles such as turtles, mammals such as beaver, muskrats, and moose, and birds such as ducks, geese, herons and bitterns. Many other animals and insects do not live in wetlands but are dependent upon them for food, such as the bald eagle.

The Commonwealth of Massachusetts regulates activities in and within 100-feet of wetlands in South Hadley through the Wetlands Protection Act, a state law enforced by the local Conservation Commission. Wetlands are protected for their eight functions: protection of public and private water supply, protection of ground water supply, flood control, storm damage prevention, prevention of pollution, protection of land containing shellfish, protection of fisheries, and protection of wildlife habitat. The most common wetlands protected by the Wetlands Protection Act are the vegetated wetlands that border rivers, streams, ponds and lakes. These 'bordering vegetated wetlands' provide critical wildlife habitat. They also play a critical role in maintaining water quality by serving as natural filters for nutrients, toxins, and sediment that would otherwise move directly into surface and ground waters. Wetlands also serve as temporary storage areas for flood waters, allowing the water to percolate slowly into the ground rather than run off quickly and violently into streams and developed areas.

Beaver Dams

Beaver activity has been increasing over the past decade. Several wetland areas have been flooded by beaver dam construction. As a result, their vegetation has changed from forested wetland to marshy habitat. Sometimes beaver activity is detrimental to property, causing problems for local land owners (e.g., flooding of wells, septic systems, lawns, out-buildings, and roadways). Affected individuals must contact the Board of Health and Conservation Commission for advice and permission to alleviate the beaver problem.

Groundwater - Water Supply

South Hadley residents derive their water supply from both surface and groundwater sources, administered by two separate political bodies, Fire Districts #1 and #2. District #1 serves approximately 70% of the Town's population, as well as sections of both Granby and Ludlow under a contract to purchase MDC Quabbin Reservoir water. Within this district, two water sources, Leaping Wells and Buttery Brook Reservoirs, were abandoned in 1950 due to poor water quality. In 1952 the Town was connected to the Quabbin via the Chicopee Valley Aqueduct System. The water supplied from District #2 is pumped from the 108-foot-deep Dry Brook Well, which is comprised of saturated sand and gravel deposits sandwiched between the approximately 80 feet of confining clay layer above and impervious bedrock below.

South Hadley has a Water Supply Protection District, shown in the Figure below, which increases lot size for those residences in the district that lack public sewer service. The District prohibits certain uses that would be detrimental to the groundwater supply.

South Hadley does not have any have non-community water systems or non-transient non-community (NTNC), but has one transient non-community water systems (TNC) – Skinner State Park.

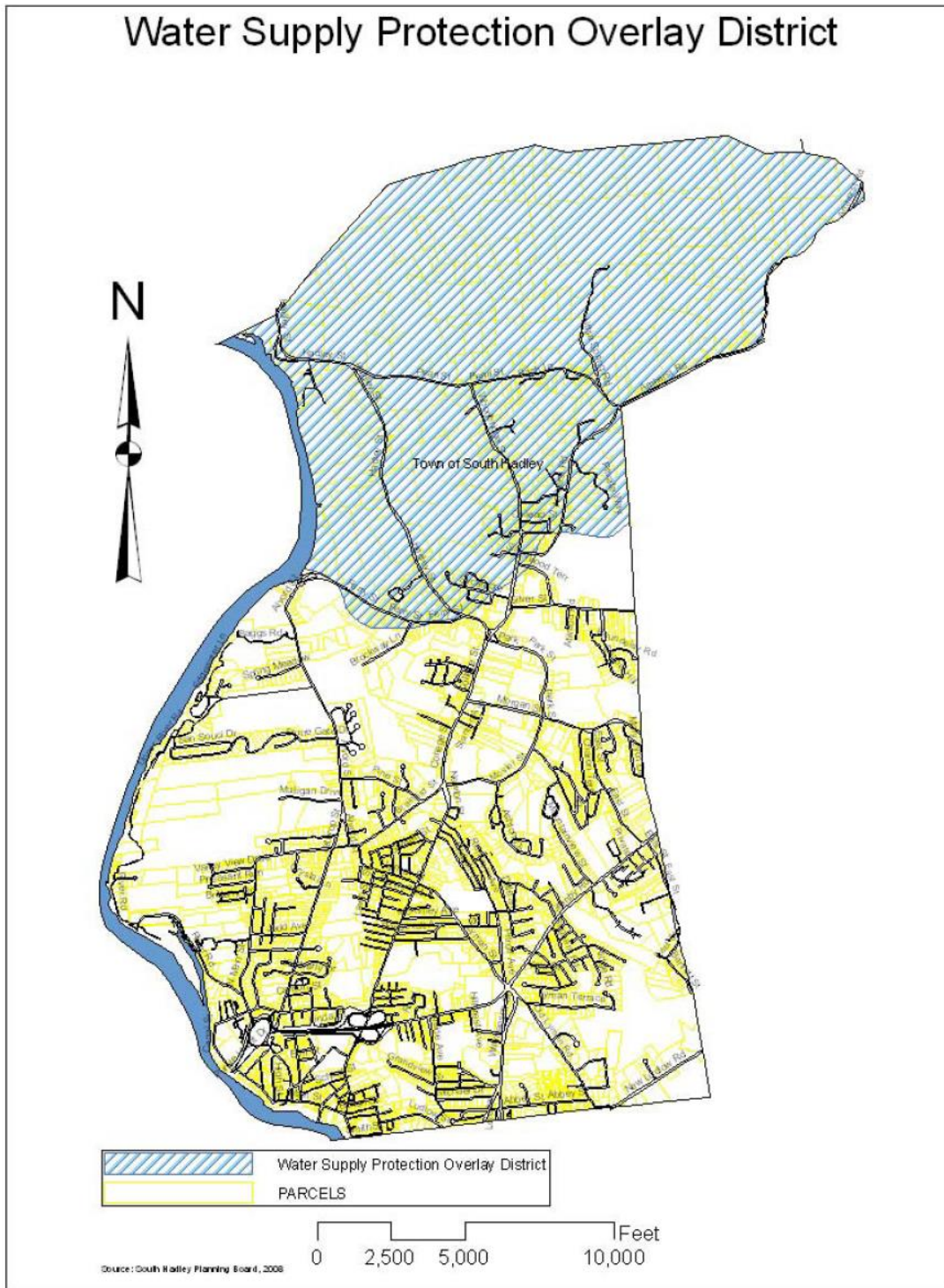


Figure 1 Water Supply Protection Overlay District

Floodways

The 100-year floodplain is defined as an area with a 1% chance of flooding in any given year. The floodplain serves as a critical habitat for many plant and animal species and provides some of the most fertile soils in the region. Areas in the 100-year flood zone in South Hadley are primarily those lands adjacent to and including the open water areas located at the Connecticut River, Bachelor Brook and Stony Brook and portions of their immediate tributaries (such as a portion of Battered Brook), shown in the Figure below. Not including open water areas, there are 1,103 acres of 100-year floodplain in Town, totaling 9.4% of the Town's area.

Protective regulations and disincentives that limit development in the floodplain exist at several levels – private and public. For example, lending institutions may require flood insurance for those structures built in the 100-year flood zone. Although the consumer cost of this federally-supported insurance program is relatively inexpensive, some prospective homeowners simply do not want to take on this added burden. Also, The Massachusetts Wetlands Protection Act and the South Hadley Wetlands Bylaw limit the impacts of construction and alteration activities in the floodplain through enforcement by the Conservation Commission. Moreover, South Hadley's zoning bylaw is an additional regulatory layer that can control development in these critical areas. South Hadley's Floodplain regulations prohibits fill and requires floor levels to be above the designated 100-year flood elevations. Finally, the State Building Code requires the elevation of structures in the floodway—the floor of the lowest habitable area in the structure must be above the base elevation for floodwaters during a 100-year storm event. The code also reinforces the overlay district regulations by prohibiting any change in the flood storage capacity of the area.

Floodways include the watercourses (rivers and streams) and adjacent relatively low-lying areas subject to periodic flooding (the 100-year flood zone and 500-year flood zone). These adjoining lands are flood hazard zones and they vary in their predicted flood frequency. South Hadley's floodways are corridors that pass flowing water downstream, eventually into the Connecticut River.

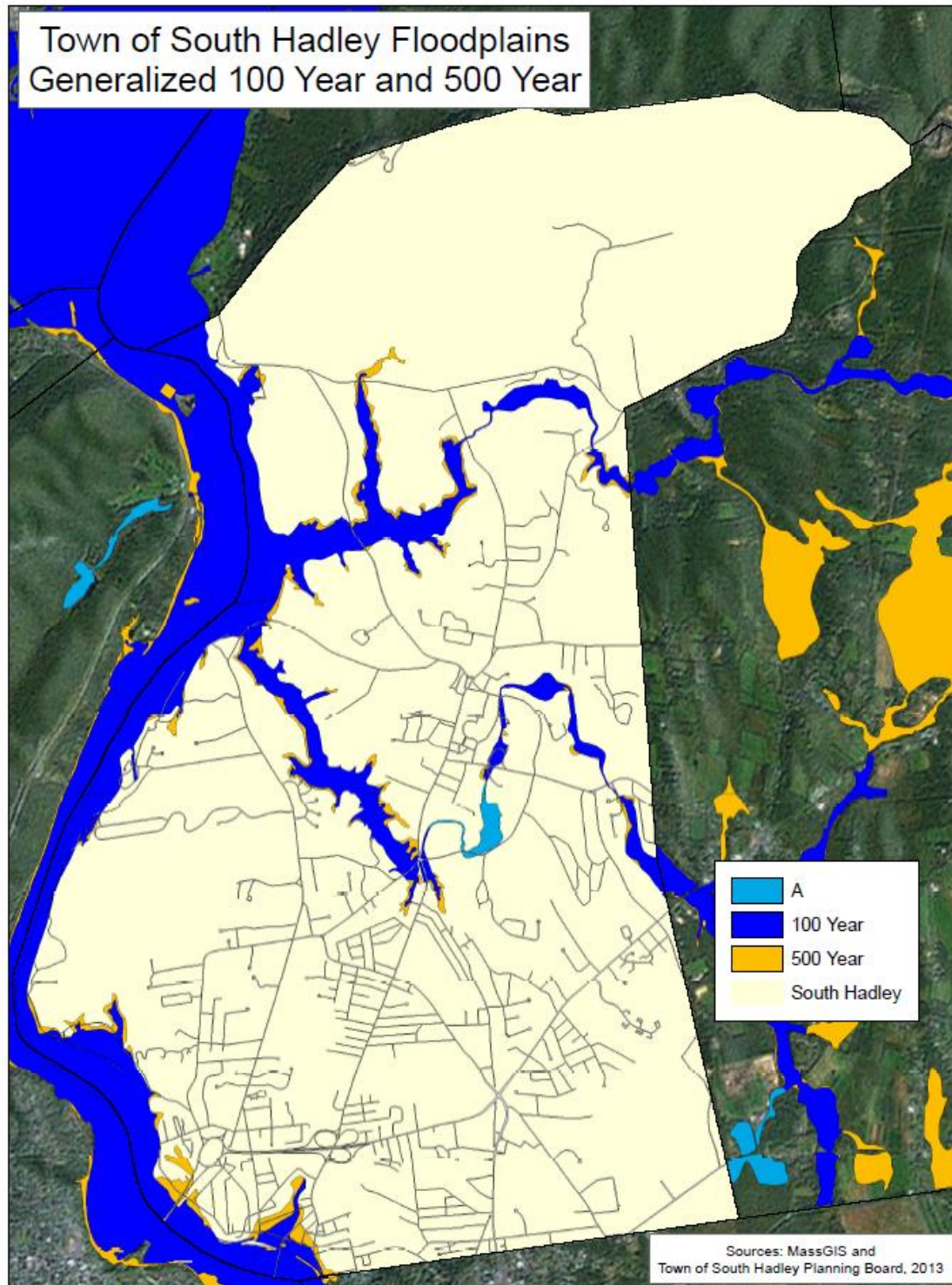


Figure 2 South Hadley Floodplains

Forests

Forest cover is by far the most prominent land use in South Hadley. South Hadley's map of existing land use shows the extensive range of these forestlands. They encompass approximately 5,639 acres, which comprises 48% of the total land area in the Town (source: MassGIS). Over 100 acres of South Hadley forestlands are protected under the Forest Legacy program. Wooded areas are habitat for bears, coyotes, deer, grouse, woodpeckers, squirrels, porcupines, and deep wood songbirds such as wood thrush, scarlet tanager, and veery.

South Hadley is in the enviable position of having significant forest and hillside resources that can provide a benefit to wildlife and residents of the community. Protecting and enhancing these resources can provide long term economic benefits as well as providing protection for the diversity of wildlife species that are fully dependent on the forestlands.

DEVELOPMENT IN SOUTH HADLEY

Several factors have played, and will continue to play, an important role in the development of South Hadley. These include: the existing development pattern and availability of land for future development; the present road network; physical factors such as steep slopes, soil conditions, land set aside for conservation, the Connecticut River, its tributaries and floodplains; and the availability of utilities such as public water and sanitary sewers. These factors have an impact, both individually and cumulatively, on where and how development occurs.

Zoning and other land use regulations constitute a town's "blueprint" for its future. Land use patterns over time will continue to look more and more like the town's zoning map until the Town is finally "built out"—that is, there is no more developable land left. Therefore, in looking forward over time, it is critical that the Town focus not on the current use and physical build-out today, but on the potential future uses and build-out that are allowed under the Town's zoning map and zoning bylaws. Zoning is a significant land use tool that the Town may use to manage development and direct growth to suitable and desired areas while also protecting critical resources and ensuring that development is in keeping with the Town's character.

Current Development Trends

Development – particularly residential development - in South Hadley slowed considerably due to the 2007-2008 economic recession. However, over the past several years, development interest has risen and several new developments are currently underway including a 29-unit condominium development off Ferry Street – Rivercrest Condominiums, a 6-lot single-family subdivision off Hadley Street – Ethan Circle, and a 4-lot single-family subdivision off Woodbridge Street – Chatham Estates. Other developments begun right before the 2007-2008 recession are approaching their completion – including Jacob's Edge Condominiums off Route 202, Stonybrook Village Condominiums off Newton Street, and Adam & Eve Estates subdivision at the end of Lyman Terrace.

Historically, development has largely focused on the land in Fire District #1 due to the availability of sewer, access, and more favorable zoning. However, all three of the residential

developments which have begun or been approved in the past several years (Rivercrest, Ethan Circle, and Chatham Estates) are in Fire District #2. As land becomes more scarce in Fire District #1, the interest in the northern 2/3's of the town is likely to grow. However, there are several large tracts of land in Fire District #1, predominately off Alvord Street, which offer significant development opportunities with available sewer, water, and relatively favorable zoning.

Commercial/Industrial development is very limited. Several small, new industrial developments have been approved and initiated within the past year along New Ludlow Road. Other industrial activities have involved reuse of existing facilities on Industrial Drive and Gaylord Street. Use of business space has actually decreased as the former Foodmart was closed by their most recent tenant – Big Y Foods. While it is likely in the near term, much of the commercial development will entail redevelopment/reuse of existing spaces, there are significant opportunities for new development along the Route 33/Willimansett Street corridor and in the Falls area – with the activation of the Redevelopment Authority.

South Hadley Zoning Districts

South Hadley has twelve base zoning districts and five overlay districts, see the Zoning Map in the Figure below. The base districts define the allowed uses and dimensional requirements in all parts of the Town, while the overlay districts provide for additional restrictions in certain areas. These districts are described below.

Residence A-1 (Low-Density Residential)

The purpose of this district is to allow residential and compatible uses, including new development that is in character with existing predominantly single-family housing, while preserving natural open spaces for their scenic quality and for ecosystem services, protection of water resources, recreation, agriculture, and forestry.

Residence A-2 (Medium-Density Residential)

The purpose of this district is to allow medium-density residential and compatible uses within developed areas of the town and to provide for new development within proximity of these developed areas that is in character with existing housing, which is predominantly single-family in nature.

Residence B (Village Residential)

The purpose of this district is to maintain the traditional character, scale, density, design, and mix of housing types that characterize the residential portions of South Hadley's historic villages.

Residence C (High Density Residential)

The purpose of this district is to accommodate relatively dense residential development, especially multi-family development in a limited number of locations.

Agricultural

The purpose of this district is to promote agriculture, forestry, recreation, and land conservation, as well as compatible open space and rural uses, by siting development in a manner that preserves large contiguous tracts of open space and agricultural land. The preservation of scenic vistas of open land, forestland, the Mount Holyoke Range, the Mount Tom Range, and the Connecticut River in this district is a key aspect of maintaining South Hadley's desired scenic and rural identity.

Business A-1 (General Business)

The purpose of this district is to create vibrant commercial areas while minimizing impacts on roads and residential districts.

Business A (Neighborhood Business)

The purpose of this district is to allow a mix of business and residential uses along major corridors where the surrounding context is predominantly residential.

Business B (Village Center Mixed Use)

The purpose of this district is to maintain the traditional scale, density, design, and mix of uses that characterize South Hadley's historic village centers and in other areas intended to develop with a similar village character, including a wide range of business uses, low-impact manufacturing, and residential use.

Business C (Planned Business)

This purpose of this district is to provide development methods that accommodate large scale businesses, while mitigating impacts on pedestrians and traffic

Industrial A

The purpose of this district is to allow low-impact industrial and business uses.

Industrial B

The purpose of this district is to allow industrial and business uses with a greater impact than those permitted in Industrial A.

Industrial Garden

The purpose of this district is to allow low-impact industrial uses, as well as compatible business uses and public-private recreation in a setting with high quality design that preserves natural scenic beauty.

Overlay Districts

South Hadley's Overlay Districts further regulate land use within the community. These include:

Water Supply Overlay District

The purpose of this overlay district is to promote the health, safety and welfare of the community by protecting and preserving the surface and groundwater resources of the Town and the region from any use of land or buildings which may reduce the quality and quantity of its water resources.

Adult Entertainment Use Overlay District

The purpose of this overlay district is to prevent the deleterious effects that Adult Entertainment uses have on the community and adjacent areas; to prevent the secondary effects associated with such uses; to protect the health, safety, and general welfare of the present and future inhabitants of the Town; and to provide for regulation of such uses without suppressing any speech or expression activities protected by the First Amendment.

South Hadley Falls Overlay District

The purpose of this overlay district is to encourage redevelopment of South Hadley Falls in a manner consistent with its historic urban pattern.

South Hadley Falls Smart Growth District

Similar in purpose to the South Hadley Falls Overlay District, this Smart Growth District was enacted under the provisions of Chapter 40R of MGL and is limited to a more defined portion of the Falls area. It also provides for higher density residential and mixed-use development by right subject to a Plan Review including Design Review.

South Hadley Zoning Map - 2016

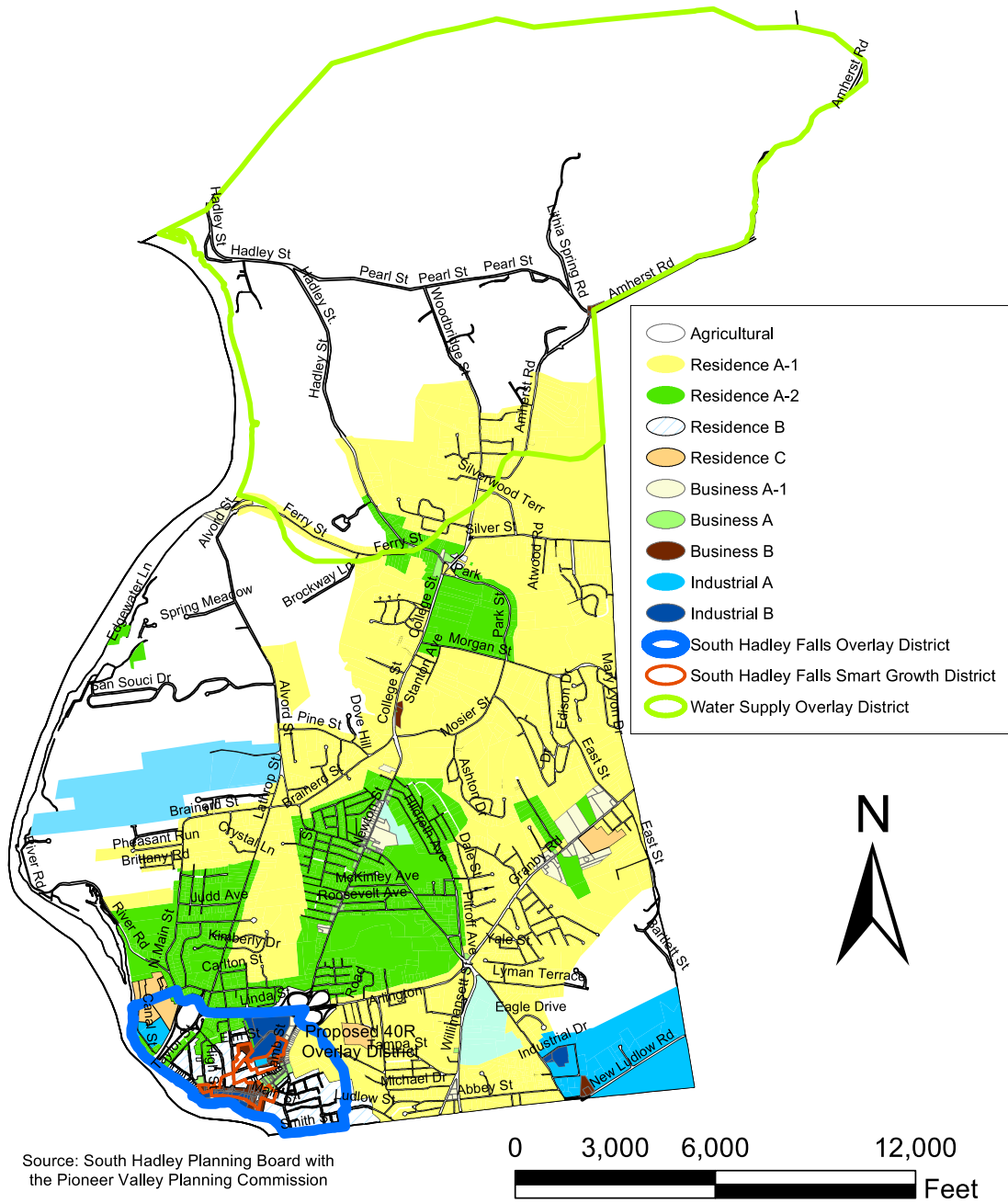


Figure 3 South Hadley Zoning Map - 2016

NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

The Town of South Hadley participates in the National Flood Insurance Program. As of November 30, 2015, there were 61 policies in effect in South Hadley for a total of \$11,561,300 in force and \$47,372 premium.¹ South Hadley entered the NFIP in 1974, their current NFIP map is dated August 15, 1979.²

The town is not a member of the Community Rating System (CRS), which entitles policyholders to a discount on flood insurance premiums. The CRS reduces flood insurance premiums to reflect what a community does above and beyond the National Flood Insurance Program's (NFIP) minimum standards for floodplain regulation. The objective of the CRS is to reward communities for what they are doing, as well as to provide an incentive for new flood protection activities. To participate in the CRS, a community must fill out an application and submit documentation that shows what it is doing and that its activities deserve at least 500 points. More information including instructions and applications is available at <http://training.fema.gov/EMIWeb/CRS/m3s1main.html>

Given the relatively low number of recurring loss properties in the Town, singular participation in the program would not likely be cost-effective; however, the Town sees potential benefit in a regional effort. Therefore, the Town of South Hadley has added a mitigation action to this plan that they would participate in a regional CRS effort.

The NFIP has produced maps that identify floodways across America. According to the NFIP maps South Hadley does not have any V-Zone properties and they have sixteen A-Zone properties. They have had a total of 23 claims since 1978. The following areas have been designated as floodways in South Hadley:

- Bachelor Brook—Pearl Street south along Route 47, Moody Corner to the Connecticut River, Pearl Street to the South Hadley Town Line;
- Stoney Brook—Town Line to Granby Road continuing on to the Mount Holyoke Campus Ponds continuing on to Route 116 and draining into the Connecticut River between Ferry and Alvord Streets;
- Connecticut River—Smith's Ferry area, the majority of the Town's western boundary, most especially within the White Brook Area;
- South Hadley's Town Center is located within the Connecticut River's 100 year flood plain, which places the Town Police Station and the Town Hall in a flood-prone area.

¹ <http://bsa.nfipstat.fema.gov/reports/1011.htm#MAT>

² <http://www.fema.gov/cis/MA.html>

HAZARD IDENTIFICATION & ANALYSIS

The Hazard Identification & Analysis chapter provides details regarding all of the natural hazards that may impact the Town of South Hadley. Gathering this information included historical research, conversations with local officials and emergency management personnel, available hazard mapping and other weather-related databases.

The Hazard Mitigation Committee referred to the 2013 Massachusetts Hazard Mitigation list of hazards and to the 2007 list of hazards included in the previous South Hadley Mitigation Plan. **Table 1** below illustrates a comparison between the relevant hazards in the state plan and in South Hadley's plan. **Table 2** indicates the three additional hazards added to the 2016 Hazard Mitigation Plan Update compared to those included in the 2007 plan.

Table 1 MA State Plan Hazards and Hazards Relevant to South Hadley

2013 Massachusetts Hazard Mitigation Plan	Town of South Hadley Relevance
Coastal Hazards	The Town of South Hadley is not located on the coast.
Dam Failure	Dam Failure is a risk to South Hadley.
Drought (Severe Weather)	Drought is a risk to South Hadley.
Earthquake	Earthquake is a risk to South Hadley.
Extreme Temperature (Severe Weather)	Extreme Temperature is a risk to South Hadley.
Flood (including Ice Jam)	Flooding is a risk to South Hadley.
High Wind (Severe Weather)	High Wind is a risk to South Hadley and is included in the Severe Thunderstorm/Wind/Tornado category.
Hurricane/Tropical Storm	Hurricane is a risk to South Hadley.
Ice Storm (Sever Winter Weather)	Ice Storm is a risk to South Hadley and included in the category Severe Snowstorms/Ice Storms..
Landslide	Landslide is a risk to South Hadley. This risk was added in 2016 due to the landfill area.
Major Urban Fires	Major Urban Fires are not considered a risk to South Hadley. However, wildfires and brush fires are considered a risk.

2013 Massachusetts Hazard Mitigation Plan	Town of South Hadley Relevance
Nor'easter	Nor'easter is a risk to South Hadley and included in the category Severe Snowstorms/Ice Storms.
Snow & Blizzard (Severe Winter Weather)	Snow & Blizzard is a risk to South Hadley and included in the category Severe Snowstorms/Ice Storms.
Thunderstorm (Severe Weather)	Thunderstorm is a risk to South Hadley and included in the category Severe Thunderstorms/Wind/Tornadoes.
Tornado (Severe Weather)	Tornado is a risk to South Hadley and included in the category Severe Thunderstorms/Wind/Tornadoes.
Tsunami	The Town of South Hadley is not located on the coast or near the coast for tsunami to be a risk.
Wildland Fire	Wildland Fire is considered a risk to the Town of South Hadley.

Table 2 Comparison between 2007 and 2016 natural hazards.

2007 Natural Hazard List	2016 Natural Hazard List
Dam Failure	Dam Failure
Drought	Drought
Earthquakes	Earthquakes
	Extreme Temperatures
Floods	Floods
Hurricanes	Hurricanes
	Landslides
Severe Snowstorms/Ice Storms	Severe Snowstorms/Ice Storms
Tornadoes	Severe Thunderstorms/Wind/Tornadoes

2007 Natural Hazard List	2016 Natural Hazard List
Wildfire/Brush Fire	Wildfire/Brush Fire
Man-made Hazards/Hazardous Materials	
	Impact of Climate Change

Three hazard categories were added to the 2016 Hazard Mitigation Plan Update, extreme temperatures, landslides and climate change. Extreme temperatures are included in the Massachusetts Hazard Mitigation Plan and are considered a risk to the Town of South Hadley for this reason the category was added. Landslides were added to this list as a result of conversation during a Hazard Mitigation Committee meeting because of the potential risk at the landfill. Climate Change was added not as a hazard category but as a factor that may impact natural hazards.

NATURAL HAZARD ANALYSIS METHODOLOGY

The analysis is organized into the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, and Vulnerability. A description of each of these analysis categories is provided below.

Hazard Description

The natural hazards identified for South Hadley are: dam failure, drought, earthquakes, extreme temperatures, floods, hurricanes, landslides, severe snowstorms/ice storms, severe thunderstorms/wind/tornadoes, wildfire/brush fire and climate change. Many of these hazards result in similar impacts to the community. For example, hurricanes, tornadoes and severe snowstorms may cause wind-related damage.

Location

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wildfires. Classifications are based on the area that would potentially be affected by the hazard, as shown in Table 3 below.

Table 3 Location of Occurrence, Percentage of Town Impacted by Given Natural Hazard

Location of Occurrence	Percentage of Town Impacted
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

Extent

Extent describes the strength or magnitude of a hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.

Previous Occurrences

Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level.

Probability of Future Events

The likelihood of a future event for each natural hazard was classified according to scale shown in Table 4.

Table 4 Frequency of Occurrence and Annual Probability of Given Natural Hazard

Frequency of Occurrence	Probability of Future Events
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

Impact

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of extent described above. Impacts are classified according to the scale shown in Table 5.

Table 5 Extent of Impacts, Magnitude of Multiple Impacts of Given Natural Hazard

Extent of Impacts	Magnitude of Multiple Impacts
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

Vulnerability

Based on the above metrics, a hazard index rating was determined for each hazard. The hazard index ratings are based on a scale of 1 (highest risk) through 5 (lowest risk). The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable. However; many of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability. Table 6 below shows the worksheet used for South Hadley.

Table 6 Identification and Analysis Worksheet for South Hadley

Type of Hazard	Location of Occurrence	Probability of Future Events	Impact	Vulnerability
Dam Failure	Large	Low	Catastrophic	3
Drought	Large	High	Minor	4
Earthquake	Large	Very low	Minor	5
Extreme Temperatures	Large	Very high	Limited	3
Flood (including Ice Jam)	Medium	Moderate	Limited	4
Hurricanes	Large	Moderate	Critical	3
Landslides	Small	Small	Minor	5
Severe Snowstorm/Ice Storm	Large	Very high	Critical	1
Severe Thunderstorm/Wind/Tornadoes	Medium	Very high	Catastrophic	1
Wildland Fire	Medium	Very High	Limited	3

Table 7 Hazard Risk Ranking

Hazard	Risk Ranking
Severe Snowstorm/Ice Storms Severe Thunderstorm /Wind/Tornado	Highest Risk (1)
Dam Failure Extreme Temperatures Hurricanes Wildland Fire	Medium Risk (3)
Drought Flood (including Ice Jam)	Low Risk (4)
Earthquake Landslides	Lowest Risk (5)

DAM FAILURE

Hazard Description

Dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control. However, they also pose a potential risk to lives and property. Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard. When a dam fails, the potential energy of the stored water behind the dam is released rapidly. Most dam failures occur when floodwaters above overtop and erode the material components of the dam. Often dam breaches lead to catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to as an “inundation area.” The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Many dams in Massachusetts were built during the 19th Century without the benefit of modern engineering design and construction oversight. Dams of this age can fail because of structural problems due to age and/or lack of proper maintenance, as well as from structural damage caused by an earthquake or flooding.

The Massachusetts Department of Conservation and Recreation Office of Dam Safety is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). To be regulated, these dams are in excess of 6 feet in height (regardless of storage capacity) and have more than 15 acre feet of storage capacity (regardless of height). Dam safety regulations enacted in 2005 transferred significant responsibilities for dams from the State of Massachusetts to dam owners, including the responsibility to conduct dam inspections.

Location

The Massachusetts Emergency Management Agency (MEMA) identifies thirteen dams in South Hadley (shown in Table 8). Six of these are High Hazard Dams, one is Significant/Medium Hazard and six are Low Hazard. High hazard dams are located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities. Low hazard dams are located where failure or improper operation may cause minimal property damage. Of South Hadley’s high hazard dams, failure of the Holyoke Dam, would result in the most significant loss of life.

Table 8 Dams in South Hadley

Dam	Hazard Level
Mt. Holyoke College Upper Pond Dam	High
Mt. Holyoke College Lower Pond Dam	High
Marcalus Manufacturing Company Dam	High
Leaping Well Reservoir Dam	High
Hillside Beach Dam	High
Holyoke Dam	High
Queensville Pond Dam	Significant
Lithia Springs Reservoir Dam	Low

Dam	Hazard Level
Newton Smith - Lower Dam	Low
Sunset Beach Upper Pond Dam	Low
Sunset Beach Tributary Dam	Low
Pearl City Pond Dam	Low
Mt. Holyoke College Middle Pond Dam	Low

It is also important to consider and plan for any potential critical failure of dams upstream in Granby and Belchertown. Belchertown has one *High Hazard* dam.

The 100-year floodplain covers about 5.4 percent, or approximately 642 acres of the town and, 1.4 percent, or roughly 160 acres, in the 500-year floodplain.

Extent

Often dam breaches lead to catastrophic consequences as the water ultimately rushes in a torrent downstream flooding an area engineers refer to as an “inundation area.” The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Dams in Massachusetts are assessed according to their risk to life and property. The state has three hazard classifications for dams:

- *High Hazard:* Dams located where failure or improper operation is likely to cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.
- *Significant Hazard:* Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.
- *Low Hazard:* Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Previous Occurrences

To date, there have been no dam failures in South Hadley.

Probability of Future Events

As South Hadley’s dams age, and if maintenance is deferred, the likelihood of a dam failure will increase, but, currently the frequency of dam failures is very low with a less than 1 percent chance of a dam failing in any given year.

As described in the Massachusetts Hazard Mitigation Plan, dams are designed partly based on assumptions about a river’s flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is

conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams are already seeing increases in stream flows from earlier releases from dams. Dams are constructed with safety features known as “spillways.” Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as “design failures,” result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, \$1,704,559,200 is used.

An estimated 100 percent of damage would occur to 20 percent of structures, resulting in a total of \$340,911,840 worth of damage and 3,220 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on this analysis, South Hadley faces a medium risk from dam failure.

DROUGHT

Hazard Description

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

Location

Because of this hazard’s regional nature, a drought would impact the entire town.

Extent

The severity of a drought would determine the scale of the event and would vary among town residents depending on whether the residents’ water supply is derived from a private well or the public water system.

The U.S. Drought Monitor also records information on historical drought occurrence. Unfortunately, data could only be found at the state level. The U.S. Drought Monitor categorizes drought on a D0-D4 scale as shown below.

Table 9 U.S. Drought Monitor

Classification	Category	Description
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

Source
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Previo
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Occurrences

In Massachusetts, six major droughts have occurred statewide since 1930.³ They range in severity and length, from three to eight years. In many of these droughts, water-supply systems were found to be inadequate. Water was piped in to urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. The following table indicates previous occurrences of drought since 2000, based on the US Drought Monitor.

Table 10 Annual Drought Status

Year	Maximum Severity
2000	No drought
2001	D2 conditions in 21% of the state
2002	D2 conditions in 99% of the state
2003	No drought
2004	D0 conditions in 44% of the state
2005	D1 conditions in 7% of the state
2006	D0 conditions in 98% of the state
2007	D1 conditions in 71% of the state
2008	D0 conditions in 57% of the state
2009	D0 conditions in 44% of the state
2010	D1 conditions in 27% of the state

³ US Geological Survey Water-Supply Paper 2375. "National Water Summary 1989 – Floods and Droughts: Massachusetts." Prepared by S. William Wandle, Jr., US Geological Survey.

2011	D0 conditions in 0.01% of the state
2012	D2 conditions in 51% of the state

Source: US Drought Monitor

Probability of Future Events

In South Hadley, as in the rest of the state, drought occurs at a rate of between 1 percent and 10 percent in a single given year.

Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that western Massachusetts may be more vulnerable than eastern Massachusetts to severe drought conditions. However, many factors, such as water supply sources, population, economic factors (i.e., agriculture based economy), and infrastructure, may affect the severity and length of a drought event.

When evaluating the region's risk for drought on a national level, utilizing a measure called the Palmer Drought Severity Index (shown in Figure 4), Massachusetts is historically in the lowest percentile for severity and risk of drought.⁴ However, global warming and climate change may have an effect on drought risk in the region. With the projected temperature increases, some scientists think that the global hydrological cycle will also intensify. This would cause, among other effects, the potential for more severe, longer-lasting droughts.

⁴ National Drought Mitigation Center – <http://drought.unl.edu>

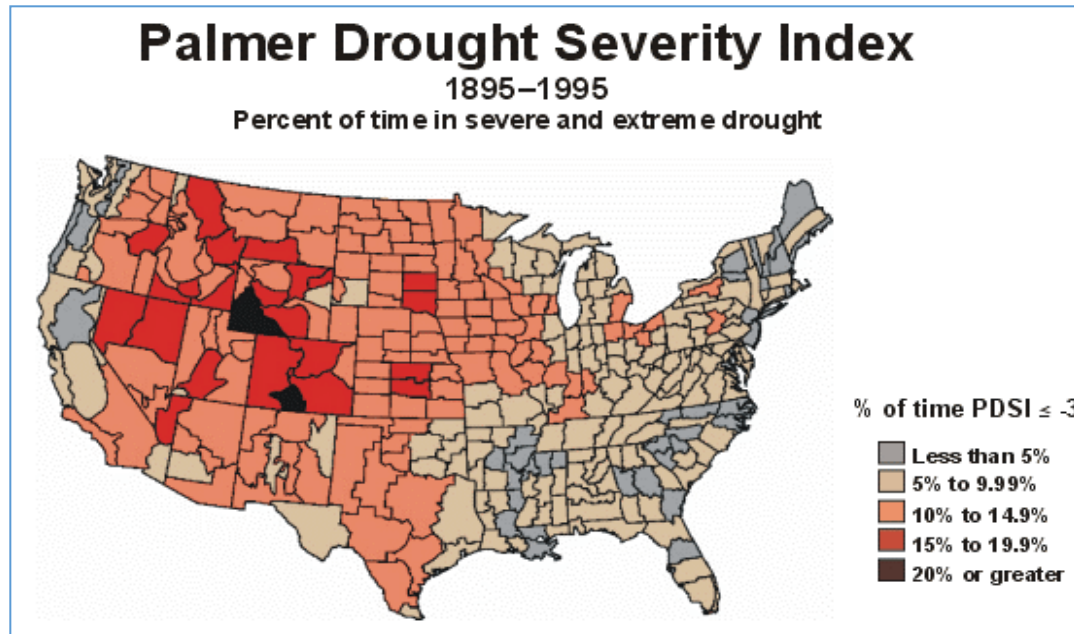


Figure 4 Palmer Drought Index

Impact

Due to the water richness of Western Massachusetts, South Hadley is unlikely to be adversely affected by anything other than a major, extended drought. While such a drought would require water saving measures to be implemented, there would be no foreseeable damage to structures or loss of life resulting from the hazard.

Vulnerability

Based on the above assessment, South Hadley faces a hazard index rating of “4- low risk” of drought.

EARTHQUAKES

Hazard Description

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth’s surface. Earthquakes can occur suddenly, without warning, at any time of the year. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.⁵ Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.⁶

⁵ Northeast States Emergency Consortium Web site: www.nesec.org/hazards/earthquakes.cfm.

⁶ Federal Emergency Management Agency Web site: www.fema.gov/hazards/earthquakes/quake.shtm.

Location

Because of the regional nature of the hazard, the entire town is equally susceptible to earthquakes.

Extent

The magnitude of an earthquake is measured using the Richter Scale (shown in Table 11), which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on the seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) increases the energy more than 30 times. The intensity of an earthquake is measured using the Modified Mercalli Scale (shown in Table 12). This scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII denoting a earthquake that causes almost complete destruction.

Table 11 Richter Scale

Magnitude	Effects
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: US Federal Emergency Management Agency

Table 12 Modified Mercalli Intensity Scale

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings	

Scale	Intensity	Description Of Effects	Corresponding Richter Scale Magnitude
		damaged.	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Previous Occurrences

The most recent earthquakes to affect New England are shown in Table 13 and the largest earthquakes in New England are shown in Table 14.

Table 13 Largest Earthquakes between 1924-2012

Location	Date	Magnitude
Ossipee, NH	December 20, 1940	5.5
Ossipee, NH	December 24, 1940	5.5
Dover-Foxcroft, ME	December 28, 1947	4.5
Kingston, RI	June 10, 1951	4.6
Portland, ME	April 26, 1957	4.7
Middlebury, VT	April 10, 1962	4.2
Near NH Quebec Border, NH	June 15, 1973	4.8
West of Laconia, NH	Jan. 19, 1982	4.5
Plattsburg, NY	April 20, 2002	5.1
Bar Harbor, NH	October 3, 2006	4.2
Hollis Center, ME	October 16, 2012	4.6

Source: Northeast States Emergency Consortium website, www.nesec.org/hazards/earthquakes.cfm

Table 14 New England States Record of Historic Earthquakes

State	Years of Record	Number Earthquakes	Of
Connecticut	1668 - 2007	137	
Maine	1766 - 2007	544	
Massachusetts	1668 - 2007	355	
New Hampshire	1638 - 2007	360	

Rhode Island	1776 - 2007	38
Vermont	1843 - 2007	73
New York	1840 - 2007	755
<i>Total Number of Earthquakes within the New England states between 1638 and 1989 is 2262.</i>		

Source: Northeast States Emergency Consortium website, www.nesec.org/hazards/earthquakes.cfm

Probability of Future Events

One measure of earthquake activity is the Earthquake Index Value. It is calculated based on historical earthquake events data using USA.com algorithms. It is an indicator of the earthquake activity level in a region. A higher earthquake index value means a higher chance of earthquake events. Data was used for Hampshire County to determine the Earthquake Index Value as shown in the table below.

Table 15 Earthquake Index for Hampshire County

Hampshire County	0.17
Massachusetts	0.70
United States	1.81

Based upon existing records, there is a low frequency of earthquakes in South Hadley with between a 1 percent and 2 percent chance of an earthquake occurring in any given year.

Impact

Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively-modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. The seismic standards have also been upgraded with the 1997 revision of the State Building Code.

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, \$1,704,559,200 is used.

An estimated 100 percent of damage would occur to 20 percent of structures, resulting in a total of \$340,911,840 worth of damage and 3,220 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on this analysis, South Hadley faces a hazard index rating of “5 - lowest risk” from earthquakes.

EXTREME TEMPERATURES

Hazard Description

As per the Massachusetts Hazard Mitigation Plan, extreme cold is a dangerous situation that can result in health emergencies for susceptible people, such as those without shelter or who are stranded or who live in homes that are poorly insulated or without heat. There is no universal definition for extreme temperatures, with the term relative to local weather conditions. For Massachusetts, extreme temperatures can be defined as those that are far outside the normal ranges. The average temperatures for Massachusetts are:

- Winter (Dec-Feb) Average = 27.51°F
- Summer (Jun-Aug) Average = 68.15°F

Criteria for issuing alerts for Massachusetts are provided on National Weather Service web pages:

<http://www.erh.noaa.gov/box/warningcriteria.shtml>.

Extent

As per the Massachusetts Hazard Mitigation Plan, the extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature Index (shown in Figure 5). Wind Chill Temperature is the temperature that people and animals feel when outside and it is based on the rate of heat loss from exposed skin by the effects of wind and cold. The chart shows three shaded areas of frostbite danger. Each shaded area shows how long a person can be exposed before frostbite develops. In Massachusetts, a wind chill warning is issued by the NWS Taunton Forecast Office when the Wind Chill Temperature Index, based on sustained wind, is –25°F or lower for at least three hours.

Extreme temperatures would affect the whole community.

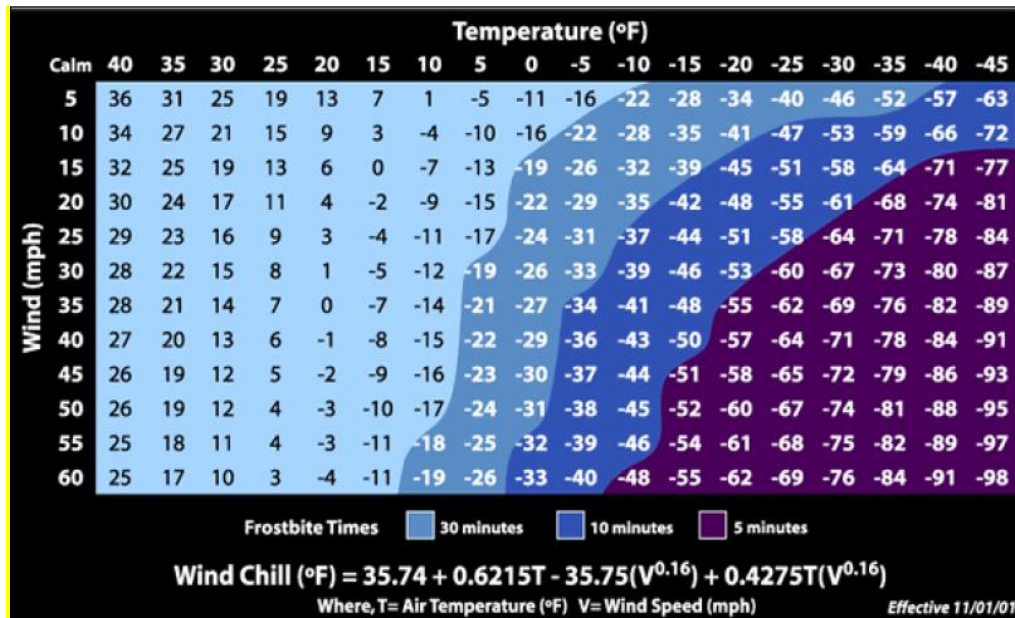


Figure 5 Wind Chills

For extremely hot temperatures, the heat index scale is used (shown in Figure 6), which combines relative humidity with actual air temperature to determine the risk to humans. The NWS issues a Heat Advisory when the Heat Index is forecast to reach 100-104 degrees F for 2 or more hours. The NWS issues an Excessive Heat Warning if the Heat Index is forecast to reach 105+ degrees F for 2 or more hours. The following chart indicates the relationship between heat index and relative humidity:

Relative Humidity (%)		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	128	136					
	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										
Category		Heat Index					Health Hazards										
Extreme Danger		130 °F – Higher					Heat Stroke or Sunstroke is likely with continued exposure.										
Danger		105 °F – 129 °F					Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.										
Extreme Caution		90 °F – 105 °F					Sunstroke, muscle cramps, and/or heat exhaustions possible with prolonged exposure and/or physical activity.										
Caution		80 °F – 90 °F					Fatigue possible with prolonged exposure and/or physical activity.										

Figure 6 Heat Index

Previous Occurrences

The following are some of the lowest temperatures recorded in parts of Massachusetts for the period from 1895 to present (Source: NOAA, www.ncdc.noaa.gov):

- Blue Hills, MA- -21°F
- Boston, MA- -12°F
- Worcester, MA- -19°F

The following are some of the highest temperatures recorded for the period from 1895 to present (Source: NOAA, www.ncdc.noaa.gov):

- Blue Hills, MA - 101°F
- Boston, MA - 102°F
- Worcester, MA - 96°F

Probability of Future Events

The probability of future extreme heat and extreme cold is considered to be "low," or between 1 and 10 percent in any given year.

Impact

The impact of extreme heat or cold in South Hadley is considered to be "minor," with no property damage and very limited affect on humans.

Vulnerability

South Hadley's vulnerability from extreme heat and cold is considered to be, "3 - Medium Risk."

FLOODING

Hazard Description

There are three major types of storms that can generate flooding in South Hadley:

- Continental storms are typically low-pressure systems that can be either slow or fast moving. These storms originate from the west and occur throughout the year.
- Coastal storms, also known as nor'easters, usually occur in late summer or early fall and originate from the south. The most severe coastal storms, hurricanes, occasionally reach Massachusetts and generate very large amounts of rainfall.
- Thunderstorms form on warm, humid summer days and cause locally significant rainfall, usually over the course of several hours. These storms can form quickly and are more difficult to predict than continental and coastal storms.

A floodplain is the relatively flat, lowland area adjacent to a river, lake or stream. Floodplains serve an important function, acting like large "sponges" to absorb and slowly release floodwaters back to surface waters and groundwater. Over time, sediments that are deposited in floodplains develop into fertile, productive farmland like that found in the Connecticut River valley. In the past, floodplain areas were also often seen as prime locations for development. Industries were located on the banks of rivers for access to hydropower. Residential and commercial development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas will result in flooding that is a costly and frequent hazard.

Location

In the 2007 Hazard Mitigation Plan, flooding issues were mentioned at Route 47 at Bachelor Brook, Abby Street, Lathrop Street, Woodbridge Street, Newton Street and Silver Street. Each of these issues has been mitigated with either a culvert replacement, pipe replacement or repair. Issues remain on River Road, Pearl Street and Sullivan Lane, these are described below.

Pearl Street

River Road

Sullivan Lane

Extent

Floods can be classified as one of two types: flash floods and general floods.

- **Flash floods** are the product of heavy, localized precipitation in a short time period over a given location. Flash flooding events typically occur within minutes or hours after a period of heavy precipitation, after a dam or levee failure, or from a sudden release of water from an ice jam. Most often, flash flooding is the result of a slow-moving thunderstorm or the heavy rains from a hurricane. In rural areas, flash flooding often occurs when small streams spill over their banks. However, in urbanized areas, flash flooding is often the result of clogged storm drains (leaves and other debris) and the higher amount of impervious surface area (roadways, parking lots, roof tops).
- **General floods** may last for several days or weeks and are caused by precipitation over a longer time period in a particular river basin. Excessive precipitation within a watershed of a stream or river can result in flooding particularly when development in the floodplain has obstructed the natural flow of the water and/or decreased the natural ability of the groundcover to absorb and retain surface water runoff (e.g., the loss of wetlands and the higher amounts of impervious surface area in urban areas).

The average annual precipitation for South Hadley and surrounding areas in western Massachusetts is 46 inches.

Previous Occurrences

The Hazard Mitigation Committee identified the locations listed under the “location” section as where previous occurrences of localized flash flooding have occurred. South Hadley has experienced many small flooding events over the last decade. Generally, these small floods have had minor impacts, temporarily impacting roads.

Probability of Future Events

The area within the 100-year flood plain still has a 1 percent chance of a severe flood in any given year. Since 1948, incidents of extreme rainfall events (large amounts of rain in a short period of time) in the U.S. have increased 30 percent. But New England states have experienced a far greater increase than the national average. In Massachusetts, the increase is 81 percent; upstream on the Connecticut River, New Hampshire is up 115 percent and Vermont is up 84 percent. (Source: Environment America Research & Policy Center, 2012). Extreme rainfall is a cause of flooding, which is a major concern of this plan.

The chances of localized flooding are over 50 percent, and thus classified as high.

Impact

The impact of a flood would be “minor,” with less than 10 percent of the town affected. The value of all residential structures in the Town of South Hadley is \$1,704,559,200 as of 2014⁷. The median value of a home in South Hadley in 2014 is approximately \$238,200, the average household size is 2.25 people, and there are 7,156 residential units in town. The data below was calculated using FEMA’s Understanding Your Risks: Identifying Hazards and Estimating Losses, August 2001. In addition, the Committee completed the Vulnerability Assessment Worksheets which provided more data to estimate the potential losses.

According to the Community Information System (CIS) of FEMA, there are 66 one to four family structures and 34 other structures located within the Special Flood Hazard Area (SFHA) in South Hadley as of May 6, 1999, the most current record in the CIS for the Town of South Hadley. Utilizing the Town’s median home value of \$238,200, a preliminary damage assessment was generated. The total damage estimate for the 66 one to four family structures located within the SFHA in South Hadley is \$15,721,200 (assumes 100 percent loss), and 149 people affected. The damage estimate is a rough estimate and likely reflects the worst case scenario.

Vulnerability

Based on the above analysis, South Hadley faces a hazard index rating of “3 - medium risk” of flooding.

HURRICANES

Hazard Description

Hurricanes are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour and which generate large amounts of precipitation. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities.

Location

Because of the hazard’s regional nature, all of South Hadley is at risk from hurricanes.

Extent

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a

⁷ Figure calculated using U.S. Census Bureau 2010 Decennial Census Data, 2008-2012 ACS Data.

hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale (shown in Table 16), which rates hurricane wind intensity on a scale of 1 to 5, with 5 being the most intense.

Table 16 Saffir-Simpson Scale

Category	Maximum Sustained Wind Speed (MPH)
1	74–95
2	96–110
3	111–129
4	130–156
5	157 +

Source: National Hurricane Center, 2012

Previous Occurrences

Hurricanes that have affected the Pioneer Valley are show in Table 17.

Table 17 Major Hurricanes in the Pioneer Valley

Hurricane/Storm Name	Year	Saffir/Simpson Category (when reached MA)
Great Hurricane of 1938	1938	3
Great Atlantic Hurricane	1944	1
Carol	1954	3
Edna	1954	1
Diane	1955	Tropical Storm
Donna	1960	Unclear, 1 or 2
Groundhog Day Gale	1976	Not Applicable
Gloria	1985	1
Bob	1991	2
Floyd	1999	Tropical Storm
Irene	2011	Tropical Storm
Sandy	2012	Super Storm

Probability of Future Events

South Hadley's location in Western Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although it can experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a low probability of hurricanes in South Hadley in any given year.

Impact

A description of the damages that could occur due to a hurricane is described by the Saffir-Simpson scale, as shown in Table 18 below.

Table 18 Hurricane Damage Classifications

Storm Category	Damage Level	Description of Damages	Wind Speed (MPH)
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	74-95
	Very dangerous winds will produce some damage		
2	MODERATE	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	96-110
	Extremely dangerous winds will cause extensive damage		
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	111-129
	Devastating damage will occur		
4	EXTREME	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	130-156
	Catastrophic damage will occur		

5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	157+
	Catastrophic damage will occur		

The 1938 and 1985 hurricanes were major events and caused wind damage and flooding statewide. There is potential for disruption of power and phone line services, structural damage to buildings, and flooding of evacuation routes.

Using a total a value of all structures in town of \$1,704,559,200 and an estimated wind damage of 5 percent of all structures with 10 percent damage to each structure, an estimated \$8,522,796 of damage would occur. Estimated flood damage to 10 percent of the structures with 20 percent damage to each structure would result in \$34,091,184 of damage. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above analysis, South Hadley faces a hazard index rating of “3 - medium risk” from hurricanes.

LANDSLIDES

Hazard Description

Landslides have not previously been identified as a hazard for the Town of South Hadley. The Hazard Mitigation Committee identified them as a possible hazard because they could occur at landfill areas causing significant damage to buildings on those sites.

The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Although gravity acting on an over steepened slope is the primary reason for a landslide, there are other contributing factors (USGS, 2013). According to the Massachusetts state geologist, Steve Mabey, slope saturation by water is a primary cause of landslides in the Commonwealth. This effect can be in the form of intense rainfall, snowmelt, changes in groundwater level, and water level changes along coastlines, earth dams, and the banks of lakes, rivers, and reservoirs. Water added to a slope can not only add weight to the slope, which increases the driving force, but can increase the pore pressure in fractures and soil pores, which decreases the internal strength of the earth materials needed to resist the driving forces.

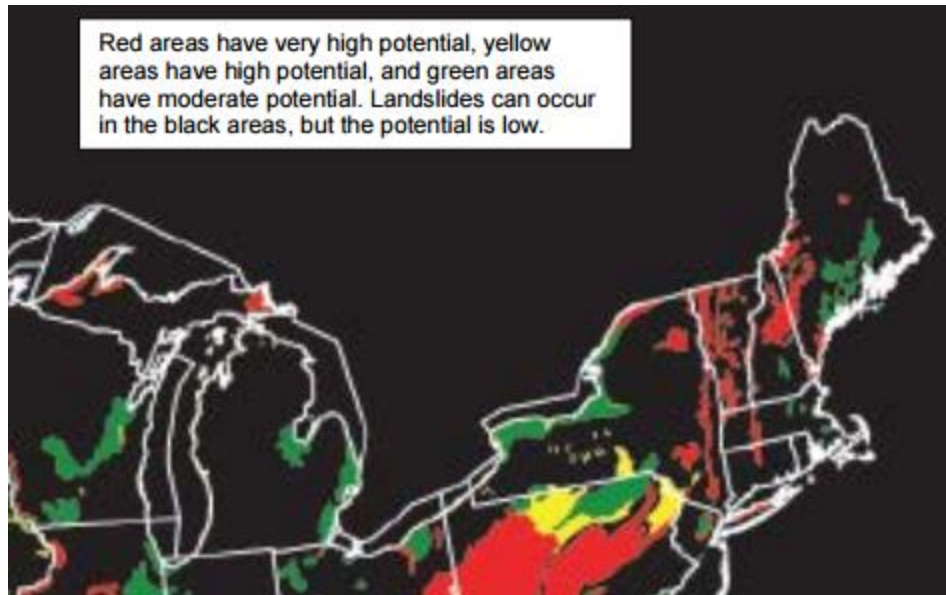
Landslides in Massachusetts can be divided into four general groups, construction related, over steepened slopes caused by undercutting due to flooding or wave action, adverse geologic conditions, and slope saturation. Construction related failures occur predominantly in road cuts excavated into

glacial till where topsoil has been placed on top of the till. This juxtaposition of materials with different permeability often causes a failure plane to develop along the interface between the two materials resulting in sliding following heavy rains. Examples can be found along the Massachusetts Turnpike. Other construction related failures occur in utility trenches excavated in materials that have very low cohesive strength and associated high water table (usually within a few feet of the surface). This occurs in sandy deposits with very few fine sediments to give the material cohesive strength and can occur in any part of the state. Undercutting of slopes during flooding or coastal storm events is a major cause of property damage. Streams and waves erode the base of the slopes causing them to over steepen and eventually collapse. This is particularly problematic in unconsolidated glacial deposits, which covers the majority of the state. Areas where this type of failure is occurring include Cape Cod, Nantucket, Martha's Vineyard, Scituate, Newbury, and along some of the major river valleys. Adverse geologic conditions exist anywhere there are lacustrine or marine clays. Clays have relatively low strength. When over steepened or exposed in excavations these areas often produce classic rotational landslides. The clays often formed in the deepest parts of many of the glacial lakes that existed in Massachusetts following the last glaciation. Some of the major glacial lakes are Bascom, Hitchcock, Nashua, Sudbury, Concord, and Merrimack. The greater Boston area is also underlain by the Boston Blue Clay, a glacio-marine clay.

Another occurrence of landslides in Massachusetts results from slope saturation. This occurs following heavy rains and dominantly in areas with steep slopes underlain by glacial till or bedrock. Bedrock is relatively impermeable relative to the unconsolidated material that overlies it. Similarly, glacial till is less permeable than the soil that forms above it. Thus, there is a permeability contrast between the overlying soil and the underlying, and less permeable, unweathered till and/or bedrock. Water accumulates on this less permeable layer increasing the pore pressure at the interface. This interface becomes a plane of weakness. If conditions are favorable failure will occur" (Mabee, 2010).

Location

The entire U.S. experiences landslides, with 36 states having moderate to highly severe landslide hazards. Expansion of urban and recreational developments into hillside areas leads to more people being threatened by landslides each year. The figure below shows landslide potential mapped by the USGS for the eastern U.S. Landslides are common throughout the Appalachian region and New England. The greatest eastern hazard is from sliding of clay-rich soils. Based on the U.S. data set for landslides, it appears that areas along the Connecticut River in western Massachusetts, and the greater Boston area have the highest risk to landslide. The figure below, excerpted from the Massachusetts Hazard Mitigation Plan, illustrates the landslide incidence and susceptibility zones in Massachusetts.



The figure below illustrates the landslide incidence and susceptibility zones in Massachusetts.

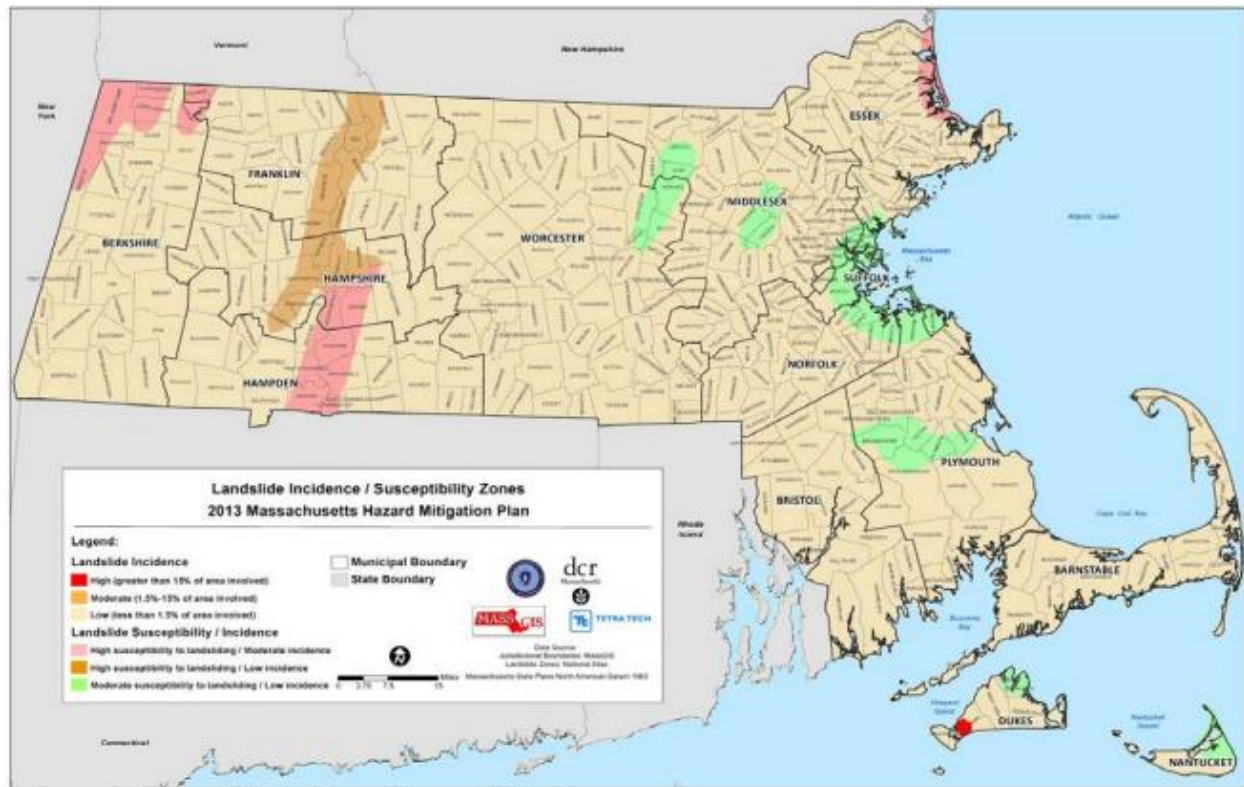


Figure 12-2. Landslide Incidence/Susceptibility Zones

Extent

To determine the extent of a landslide hazard, the affected areas need to be identified and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, defined below:

Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15-percent of a given area has been involved in landsliding; medium incidence means that 1.5 to 15-percent of an area has been involved; and low incidence means that less than 1.5-percent of an area has been involved.

Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence

of landsliding. Landslides destroy property and infrastructure and can take the lives of people. Slope failures in the United States result in an average of 25 lives lost per year and an annual cost to society of about \$1.5 billion.

Previous Occurrences

South Hadley has no record of previous landslides.

Probability of Future Events

The probability is considered low for future events in the Town of South Hadley.

Impact

The impact of a landslide would be limited to the landfill site and to equipment and buildings on that site.

Vulnerability

Based on the above assessment, South Hadley has a hazard index rating of “5 –lowest risk” from Landslides.

SEVERE SNOWSTORMS/ICE STORMS

Hazard Description

Severe winter storms can pose a significant risk to property and human life. The rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can cause the following hazards:

- Disrupted power and phone service
- Unsafe roadways and increased traffic accidents
- Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt.
- Tree damage and fallen branches that cause utility line damage and roadway blockages
- Damage to telecommunications structures
- Reduced ability of emergency officials to respond promptly to medical emergencies or fires.

Location

The entire Town of South Hadley is susceptible to severe snowstorms. Because these storms occur regionally, they would impact the entire town.

Extent

The Northeast Snowfall Impact Scale (NESIS), shown in Table 19, developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004)

characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus NESIS gives an indication of a storm's societal impacts.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

Table 19 Northeast Snowfall Impact Scale Categories

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

Source: <http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>

Previous Occurrences

New England generally experiences at least one or two severe winter storms each year with varying degrees of severity. Severe winter storms typically occur during January and February; however, they can occur from late September through late April.

Based on data available from the National Oceanic and Atmospheric Administration, there are 47 winter storms since 1958 that have registered on the NESIS scale. Of these, approximately 26 storms resulted in snow falls in the Pioneer Valley of at least 10 inches (shown in Table 20). These storms are listed in the table on the next page, in order of their NESIS severity.

Table 20 Winter Storms Producing Over 10' of Snow in the Pioneer Valley, 1958-2013

Date	NESIS Value	NASIS Category	NESIS Classification
3/12/1993	13.2	5	Extreme
3/2/1960	8.77	4	Crippling
2/15/2003	7.5	4	Crippling
2/2/1961	7.06	4	Crippling

Date	NESIS Value	NASIS Category	NESIS Classification
1/21/2005	6.8	4	Crippling
1/19/1978	6.53	4	Crippling
12/25/1969	6.29	4	Crippling
2/10/1983	6.25	4	Crippling
2/14/1958	6.25	4	Crippling
2/5/1978	5.78	3	Major
2/23/2010	5.46	3	Major
2/8/1994	5.39	3	Major
1/9/2011	5.31	3	Major
2/18/1972	4.77	3	Major
12/11/1960	4.53	3	Major
2/7/2013	4.35	3	Major
2/22/1969	4.29	3	Major
1/18/1961	4.04	3	Major
2/8/1969	3.51	2	Significant
2/5/1967	3.5	2	Significant
4/6/1982	3.35	2	Significant
3/4/2013	3.05	2	Significant
3/15/2007	2.54	2	Significant
3/31/1997	2.29	1	Notable
2/2/1995	1.43	1	Notable
1/25/1987	1.19	1	Notable

Source: <http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis>

Probability of Future Events

Based upon the availability of records for Hampshire County, the likelihood that a severe snow storm will hit South Hadley in any given year is greater than 50 percent.

Research on climate change indicates that there is great potential for stronger, more frequent storms as the global temperature increases. More information about the effect of Climate Change can be found in the Pioneer Valley Planning Commission's Climate Action Plan, available at www.sustainableknowledgecorridor.org.

The Massachusetts State Climate Change Adaptation Report has additional information about the impact of climate change and can be accessed at www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all residential property in town, \$1,704,559,200, is used. An estimated 20 percent of damage would occur to 10 percent of structures, resulting in a total of \$34,091,184 worth of damage.

The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, South Hadley faces a hazard index rating of “1 - highest risk” from severe snowstorms and ice storms. The impact of an ice storm could be catastrophic in South Hadley.

SEVERE THUNDERSTORMS / WIND / TORNADOES

Hazard Description

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes hail. Effective January 5, 2010, the NWS modified the hail size criterion to classify a thunderstorm as ‘severe’ when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013).

Wind is air in motion relative to surface of the earth. For non-tropical events over land, the NWS issues a Wind Advisory (sustained winds of 31 to 39 mph for at least 1 hour or any gusts 46 to 57 mph) or a High Wind Warning (sustained winds 40+ mph or any gusts 58+ mph). For non-tropical events over water, the NWS issues a small craft advisory (sustained winds 25-33 knots), a gale warning (sustained winds 34-47 knots), a storm warning (sustained winds 48 to 63 knots), or a hurricane force wind warning (sustained winds 64+ knots). For tropical systems, the NWS issues a tropical storm warning for any areas (inland or coastal) that are expecting sustained winds from 39 to 73 mph. A hurricane warning is issued for any areas (inland or coastal) that are expecting sustained winds of 74 mph. Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, etc. High winds can cause scattered power outages. High winds are also a hazard for the boating, shipping, and aviation industry sectors.

Tornadoes are swirling columns of air that typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester, including towns in eastern Hampshire County. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property (cars, etc.).

Location

As per the Massachusetts Hazard Mitigation Plan, the entire town is at risk of high winds, severe thunderstorms, and tornadoes.

Extent

An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms. Thunderstorms can cause hail, wind, and flooding.

Tornadoes are measured using the enhanced Fujita Scale, shown in Table 21 with the following categories and corresponding descriptions of damage:

Table 21 Enhanced Fujita Scale Levels and Descriptions of Damage

EF-Scale Number	Intensity Phrase	3-Second Gust (MPH)	Type of Damage Done
EF0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

Previous Occurrences

Microbursts and tornadoes are not uncommon in the region, and they are expected to become more frequent and more violent as the earth's atmosphere warms, due to predictions of climate change from global warming. In the last fifty years, one known tornado has touched down in neighboring Hadley, and there have been several high-wind storms and hail events. In Western Massachusetts, the majority of sighted tornadoes have occurred in a swath from Southwick to New Salem, and South Hadley sits directly within this "tornado alley."

Probability of Future Events

One measure of tornado activity is the tornado index value. It is calculated based on historical tornado events data using USA.com algorithms. It is an indicator of the tornado level in a region. A higher tornado index value means a higher chance of tornado events. Data was used for Hampshire County to determine the Tornado Index Value as shown in the table below.

Table 22 Tornado Index for Hampshire County

Hampshire County	125.73
Massachusetts	87.60
United States	136.45

Source: USA.com

<http://www.usa.com/hampshire-county-ma-natural-disasters-extremes.htm>

Based upon the available historical record, as well as South Hadley's location in a high-density cluster of state-wide tornado activity, it is reasonable to estimate that there is a low frequency of tornado occurrence in South Hadley in any given year.

As per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year.

Impact

The potential for locally catastrophic damage is a factor in any tornado, severe thunderstorm, or wind event. In South Hadley, a tornado that hit the residential areas would leave much more damage than a tornado with a travel path that ran along the agricultural areas. Most buildings in the Town of South Hadley have not been built to Zone 1, Design Wind Speed Codes. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, with most of the Town's housing built before this date.

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, \$1,704,559,200 is used. An estimated 100 percent of damage would occur to 1 percent of structures, resulting in a total of \$17,045,592 worth of damage and 161 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, South Hadley has a hazard index rating of "1 – highest risk" for severe thunderstorms and winds and tornadoes. A tornado in South Hadley could create catastrophic damages.

WILDFIRE / BRUSHFIRE

Hazard Description

Wildland fires are typically larger fires, involving full-sized trees as well as meadows and scrublands. Brushfires are uncontrolled fires that occur in meadows and scrublands, but do not involve full-sized trees. Both wildland fires and brushfires can consume homes, other buildings and/or agricultural resources. Typical causes of brushfires and wildfires are lightning strikes, human carelessness, and arson.

FEMA has classifications for 3 different classes of wildland fires:

- Surface fires – the most common type of wildland fire, surface fires burn slowly along the floor of a forest, killing or damaging trees.
- Ground fires burn on or below the forest floor and are usually started by lightening
- Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

Location

Hampden and Hampshire County have approximately 469,587 acres of forested land, which accounts for 62 percent of total land area. However, Massachusetts receives more than 40 inches of rain per year and much of the landscape is fragmented, and together these two traits make wildfires uncommon in Massachusetts. Nevertheless, in drought conditions, a brushfire or wildfire would be a matter of concern.

Extent

South Hadley is approximately 48% forestland. A large wildfire in South Hadley could cause serious damage to the town's land mass in a short period of time. Wildfires can cause widespread damage to the areas that they affect. They can spread very rapidly, depending on local wind speeds and be very difficult to get under control. Fires can last for several hours up to several days.

Previous Occurrences

During the past 100 years, there have not been many wildfires occurring in the Pioneer Valley. However, several have occurred during the past 20 years, as shown in the list below:

- 1995 – Russell, 500 acres burned on Mt. Tekoa
- 2000 – South Hadley, 310 acres burned over 14 days in the Litihia Springs Watershed
- 2001 – Ware, 400 acres burned
- 2010 – Russell, 320 acres burned on Mt. Tekoa
- 2012 – Eastern Hampden County, dry conditions and wind gusts created a brush fire in Brimfield, and burned 50 acres

Each of the Districts issue burn permits. In District 2, they may have five unpermitted burns to every 100 permits issued.

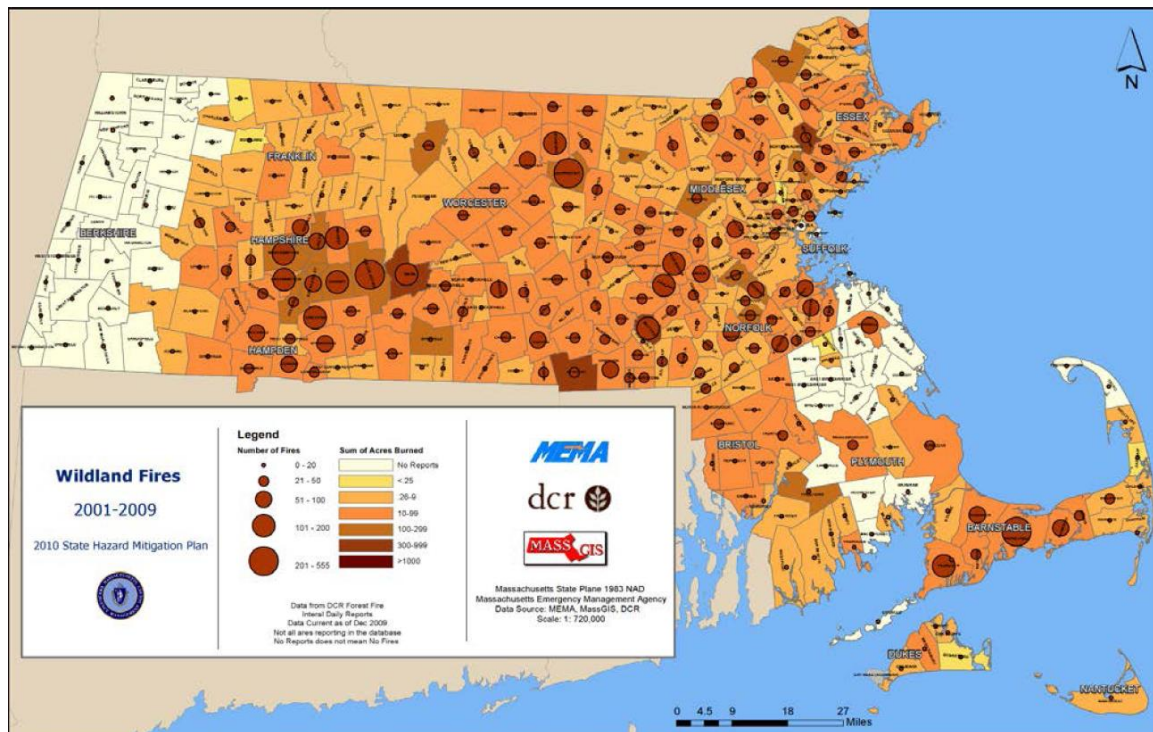


Figure 7 Wildland Fires in Massachusetts, 2001-2009

Source: Massachusetts Hazard Mitigation Plan

Probability of Future Events

In accordance with the Massachusetts Hazard Mitigation Plan, the Town Hazard Mitigation Committee found it is difficult to predict the likelihood of wildfires in a probabilistic manner because the number of variables involved. However, given the proximity of previous wildfires, and their proximity to the Town, the likelihood of a future wildfire is determined to be medium.

Climate scenarios project summer temperature increases between 2°C and 5°C and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide—the so-called “fertilization effect”—could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, \$1,704,559,200, is used.

An estimated 100 percent of damage would occur to 1 percent of structures, resulting in a total of \$17,045,592 worth of damage and 161 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, South Hadley faces a hazard index rating of “3 - medium risk” from wildfires.

IMPACTS OF CLIMATE CHANGE

Climate change is already causing natural hazards to have more of an impact on South Hadley, with hotter summers, wetter winters, more severe storms, and more frequent flooding. In the future, general climatic changes are projected to result in South Hadley experiencing higher temperatures and more precipitation. There will also be wider variability in weather extreme and more days of extreme heat above 90 degrees, more heat waves, more floods, more droughts, and more tornados, hurricanes and heavy storms.

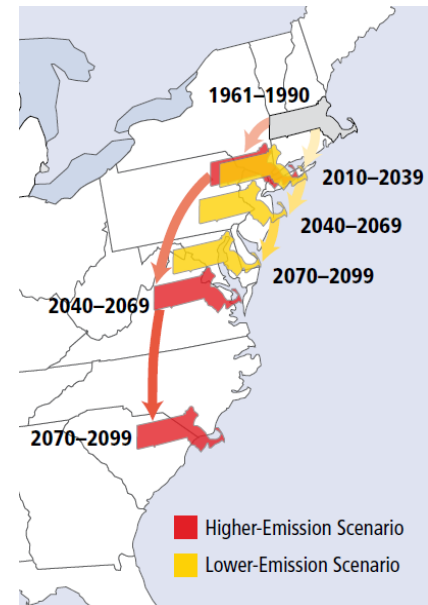
This change in climate will expand the area of South Hadley that is within the 100-year and 500-year floodplain, affect critical resources and vulnerable populations, alter local food production, increase the risk of wildfires, and result in increased damage to people and property.

This section identifies the impacts that climate change will have to the various identified hazards affecting South Hadley. The information included is derived from several accepted sources:

- The 2007 report of the Northeast Climate Impacts Assessment (NECIA)
- The Pioneer Valley Planning Commission’s *Our Next Future: An Action Plan for Building a Smart, Resilient Pioneer Valley*, which includes climate change projections
- The Massachusetts Climate Change Adaptation Report
- The Massachusetts Multi-Hazard Mitigation Plan

The mitigation strategies included in the Mitigation Strategy also take into account the impacts of climate change and provide adaptation strategies where appropriate.

While the exact extent is still uncertain, it is clear that climate change is occurring and will greatly affect South Hadley in the upcoming decades. In order to prepare for changes in severe weather and flooding, the Town of South Hadley has adopted the 500-year floodplain standard in place of a 100-year floodplain, since it is expected that storms currently considered to be 500-year floods will occur more frequently in the future. As additional climate change research is completed, the town will continue to refine its flooding estimates.



At current rates of greenhouse gas accumulation and temperature increases, the climate of Massachusetts will become similar to those of present-day New Jersey or Virginia by 2040-2069, depending on future GHG emissions..
Source: NECIA 2006

Increased Flooding

By the end of the 21st century, annual precipitation is expected to increase by 14 percent – however, this increase will be a result of more winter precipitation – an increase of 30 percent– while summer precipitation will actually slightly decrease. Additionally, most of this winter precipitation is projected to be in the form of rain rather than snow. This will result in a continuation of the current trend of an overall decrease in total snowfall, as well as the number of days that have snow cover. The increased amount of strong precipitation events and overall increase in rainfall will likely result in more flooding in the region.

Table 23 Expected Climatic Variations Due to Climate Change

Category	Current (1961-1990 avg.)	Predicted Change 2040-2069	Predicted Change 2070-2099
Average Annual Temperature (°F)	46°	50° to 51°	51° to 56°
Average Winter Temperature (°F)	23°	25.5° to 27°	31° to 35°
Average Summer Temperature (°F)	68°	69.5° to 71.5°	74° to 82°
Days over 90 °F	5 to 20 days	-	30 to 60 days
Days over 100 °F	0 to 2 days	-	3 to 28 days
Annual Precipitation	41 inches	43 to 44 inches	44 to 47 inches
Winter Precipitation	8 inches	8.5 to 9 inches	9 to 10.4 inches
Summer Precipitation	11 inches	10.9 to 10.7 inches	10.9 to 11 inches

Sources: *Massachusetts Climate Adaptation Report 2011, NECIA*

Increased flooding will have the following projected impacts to people and property:

- Increased instances of standing water will lead to increased mosquito populations and greater risk of disease vectors.

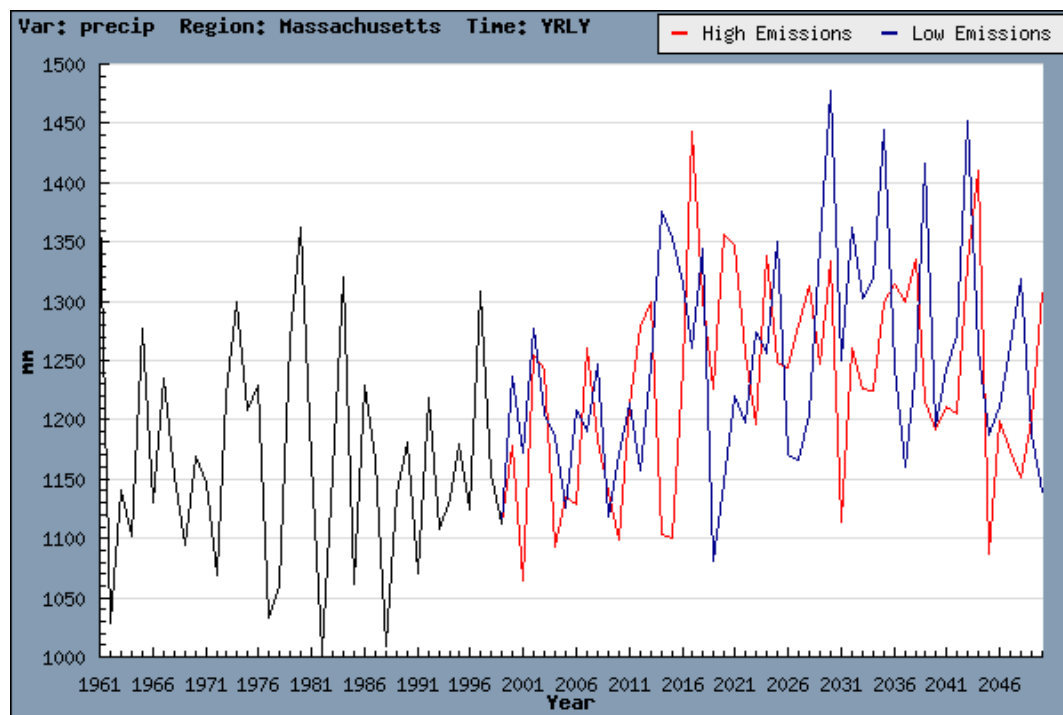


Figure 8 Massachusetts Rainfall 1961-2050

Rainfall has increased approximately 10% during the past 50 years, and is expected to continue to increase. *Source: NECIA*

Increased Temperatures

Average temperatures in the Pioneer Valley have been increasing over time in the Pioneer Valley due to climate change, and this trend is likely to continue in the future. Higher temperatures due to climate change will likely have an effect on future drought risk in South Hadley. The climate of the Pioneer Valley is strongly influenced by the weather patterns of the larger Northeast United States, a region ranging from Pennsylvania to Maine. Average temperatures in the Northeast have been increasing since the late 1800s. The overall average annual temperature increase in this area has been approximately .9 degrees C (1.5°F) since approximately 1900.

According to records of the United States Historical Climatology Network, most of this temperature increase has occurred recently, with an average increase of about 0.2 degrees C (0.5°F) per decade since 1970. These higher average temperatures have primarily been the result of warmer winters (December through March), during which there has been an increase of 1.3°F per decade since 1970. In addition to average temperature increases, the number of extremely hot and record heat days has also increased: the number of days with temperatures of 90°F and higher throughout the Northeast has doubled during the past 45 years. The northern portion of the Northeast currently sees about 5 days per year with temperatures over 90°F and no days over 100°F, while the southern portion sees up to 20 days over 90°F and 2 days over 100°F.

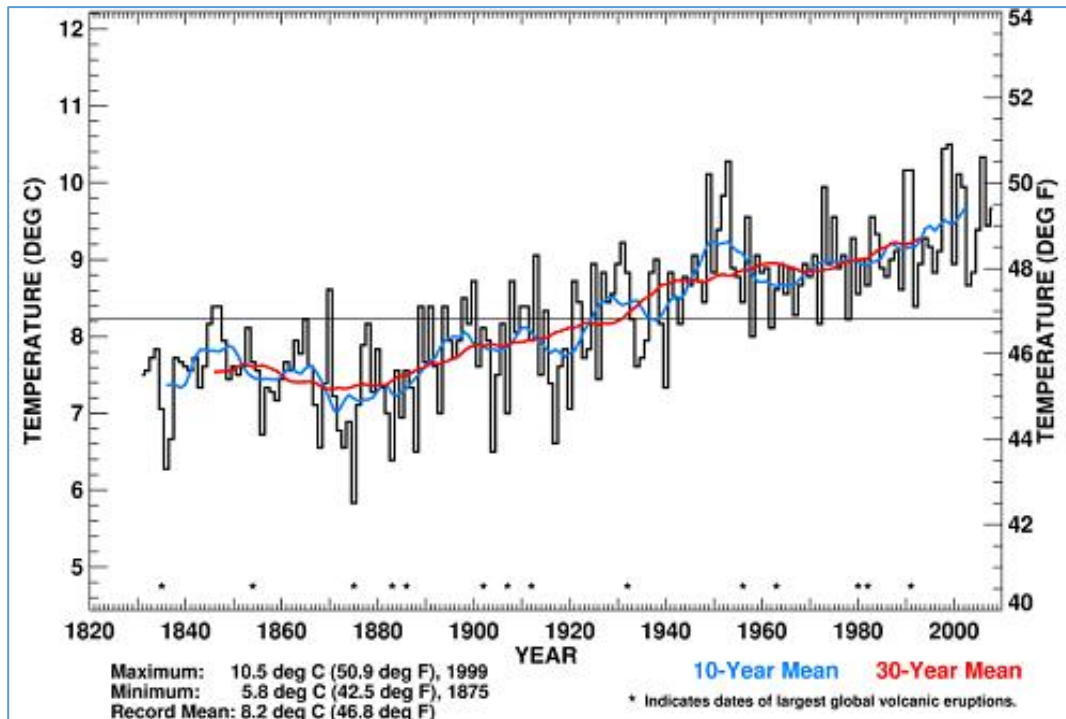


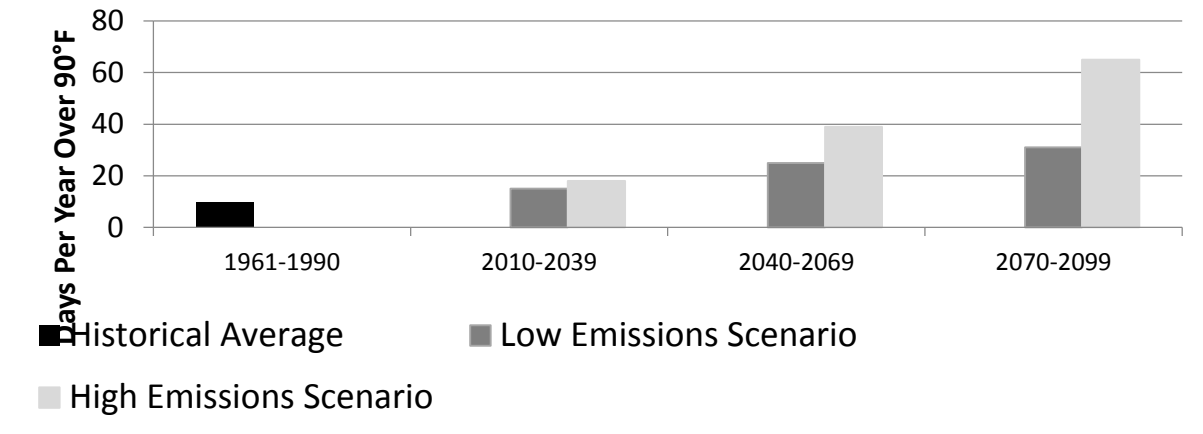
Figure 9 Northeast U.S. Region Annual Average Temperatures 1831-2008

temperatures steadily increasing at the National Weather Service's Blue Hill Observatory, the home of the oldest continuously recorded weather records in the U.S. Source: Michael J. Iacono, Atmospheric and Environmental Research, Inc./ Blue Hill Observatory, MA. Plot includes temperature data for 1831–1884 from Milton and Canton that were adjusted to the Blue Hill summit location.

Increased temperatures will have the following projected impacts to people and property:

- Increased temperatures will put stress on current food production and require farming operations to adjust by planting new varieties of crops.
- Changes are also likely to introduce new insect species, pests, and invasive plant species to the region, which will result in further threats to food production and also adversely affect natural systems and biodiversity. Additional prominence of ticks may potentially also lead to more occurrence of Lyme disease.
- Increased energy usage in order to cool buildings in the summer and long-term electrical needs will increase.
- Greater stress on special populations, such as senior citizens, without access to air conditioning during heat waves.

Predicted Days Over 90°F in Concord / Manchester, NH



Severe Weather

Temperature and precipitation changes in the region will lead to increased severe and extreme weather events, including:

- Slight decrease in summer precipitation that will result in an increase in the number of droughts. Short-term (1 to 3 month) droughts are likely to increase in their frequency in the Northeast to the level of once per year. According to the Connecticut Climate Adaptation Report, “Facing Our Future,” the occurrence of drought in that state is already increasing, with shallower lakes drying up.⁸
- Decreased rainfalls will potentially create more occurrences of wildfires.
- Less dependable rainfall will also impact the Pioneer Valley’s food systems, in the form of less dependable rainfall and require the region’s farming operations to evolve.
- Increased occurrences of major snowstorms, especially during times previously considered unseasonably warm. Should storms occur when there are still leaves on trees, there could be great damage due to broken limbs, as happened during the snowstorm of 2011.
- Increased occurrences of severe thunderstorms and hurricanes, which will result in more wind damage from major storms and greater flooding.

Secondary Effects

- Disruption of communications services due to damage to cellular phone towers and other communications devices.

⁸ State of Connecticut Department of Environmental Protection. Facing Our Future: Adapting to Connecticut’s Changing Climate. March 2009.

- Increased costs of home ownership due to higher flood insurance premiums, which will disproportionately affect low income residents.
- Higher difficulty in the ability of residents to obtain basic services that are heavily reliant on electricity after severe weather events, including gasoline and perishable food items.

CRITICAL FACILITIES

A Critical Facility is defined as a building, structure, or location which:

- Is vital to the hazard response effort,
- Maintains an existing level of protection from hazards for community residents and property
- Would create a secondary disaster if a hazard were to impact it

The critical facility list from the 2007 Hazard Mitigation Plan was revised by the Hazard Mitigation Committee. The Hazard Mitigation Committee developed the nine main categories of critical facilities:

1. Emergency Operation Centers
2. Police Stations
3. Fire Stations
4. Schools
5. Town Facilities
6. Utilities
7. Population
8. Economy
9. Historic Buildings/Sites

These nine categories represent the facilities necessary for emergency response for all types of disasters, facilities necessary for Town sustainability and facilities that include special populations. A map showing the location of each critical facility is shown in the table below. The table includes the name, location and purpose of each facility. It also indicates if the facility has a generator attached to it.

Table 24 List of Critical Facilities

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
Emergency Operation Center (EOC)	South Hadley Police Department (EOC)	If the Holyoke Dam breaches this EOC would be flooded.	41 Bridge Street	Yes (1 fixed generator, 1 portable generator)
Police Station	South Hadley Police Department	Primary EOC	41 Bridge Street	Yes (1 fixed generator, 1 portable generator)
Fire Stations	South Hadley District 1 Fire Department	Backup EOC	144 Newton Street	Yes
	South Hadley District	Backup EOC	20 Woodbridge Street	Yes

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	2 Fire Department			
Schools/Colleges				
Public Schools	Plains Elementary	Shelter	00 Lyman Street	Yes
	Mosier Elementary	This facility needs renovation. The generator only powers the kitchen.	101 Mosier Street	Yes
	Michael E. Smith Middle School	Shelter	100 Mosier Street	Yes
	South Hadley High	Shelter	153 Newton Street	Yes
	Pioneer Valley Performing Arts Charter Public School		15 Mulligan Drive	
Private Schools	Mount Holyoke College	Shelter for their students and staff	50 College Street	Yes
	Berkshire Hills Music Academy	Special needs children	48 Woodbridge Street	
	R. F. K. Girls Program		Canal Street	
	Gorse Child Study Center		27 Morgan Street	
	The Canal Village School		30 Carew Street	
Daycares	Criterion/Rish & Shine Academy		30 Old Lyman Road	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Brighter Beginnings		411 Granby Road	
	Playful Minds		11 North Main Street	
	The Canal Village School		30 Carew Street	
	The Gorse Children's Center		27 Morgan Street	
	Alphabet Soup Preschool Plus		5 Ferry Street	
	Center Nursery school		1 Church Street	
Camps	Camp Perkins (Girl Scouts)		5 Camp Perkins Rd.	
	Mount Holyoke College Summer Programs		50 College Street	
	Mosier Elementary		101 Mosier Street	
	Michael E. Smith Middle School		100 Mosier Street	
Town Facilities	Town Hall		116 Main Street	
	Council on Aging	Senior Center	45 Dayton Street	
	South Hadley Public Library		2 Canal Street	
	Gaylord Memorial Library		47 College Street	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
Utilities				
Dry Hydrants	Leaping Wells Reservoir		438 Granby Road	
Highway Garage	Department of Public Works		10 Industrial Drive	Yes (one 75 kw generator, two portable generators)
Water Department	District #1 Office	Office and Garage	438 Granby Road	
	District #1 – Quabbin Trunk			
	District #1 – Mulligan Drive Water Tank	Water Tank	14 Mulligan Drive	
	District #1 – Industrial Drive Water Tank	Water Tank	8 Industrial Drive	
	District #2 Office	Office and Garage (share bldg with fire dept.)	20 Woodbridge Street	Yes
	District #2 – Sullivan Lane	Pump station		
	District #2 – Park Street Tank	Water Tank		
	District #2 – Skinner Lane Water Tank	Water Tank		
Waste Water	Waste Water Treatment Plant		2 James Street, Chicopee, MA	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Main Street Pump Station		145 Main Street	
	Stony Brook Pump Station			
	Morgan Street Pump Station			
	Toper Station (Sycamore Parc)			
	Old Sycamore Knolls Pump Station			
Electric	Mount Holyoke College Substation		50 College Street	
	South Hadley Electric Light Department		85 Main Street	
Natural Gas	Natural Gas Compressor Station for Columbia Gas		located in Chicopee on New Ludlow Road but serves South Hadley	
Emergency Fuel Stations	South Hadley Electric Light Department, diesel and gas for Districts #1 and #2 Fire Departments			
	Department of Public Works, 1,000 gallon diesel tank			Yes (one 75 kw generator, two portable generators)
	Haydocy Gas Station, Lamb Street (Police,			(may not have

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Ambulance and DPW)			emergency power)
	Marion Excavating		500 New Ludlow Road	
	Convenience Plus		467 Newton Street	
	Convenience Plus		483 Granby Road	
	Mount Holyoke College		50 College Street	Yes
	Morgan Station			
Communication				
Cell Towers	Amherst Road Cell Tower			
	Industrial Drive, Water Tank	3 cell carriers		
	Mulligan Drive Water Tank	4 cell carriers		Yes
	Skinner Lane Water Tank	2 cell carriers		(plug-in ready)
	Shattuck Hall, Mount Holyoke College		50 College Street	
Telephone Cross Boxes	Woodbridge Street at Silverwood Terrace			
	West Summit Street			
	Morgan Street at College Street			

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Main Street at Pump Station			
	Alvord Street Extension			
Transfer Station	South Hadley Transfer Station		10 Industrial Drive	
Helicopter Landing Sites	Recreation Field behind Kendall Hall, Mount Holyoke Campus		50 College Street	
	South Hadley High School Recreational Field		153 Newton Street	
	Pioneer Valley Performing Arts School		15 Mulligan Drive	
Primary Evacuation Routes	Routes 47, 116, 202, 33			
Bridges on Evacuation Routes	Bachelor Brook Bridge		Route 47	
	Bachelor Brook Bridge		Route 116	
	Veterans Memorial Bridge		Route 116	
	Stony Brook Bridge		Route 116	
	Muller Bridge		Route 202	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
Problem Culverts	River Road			
	Pearl Street			
	Route 47			
	Rt.202 across from Leaping Wells			
Population				
Elderly Housing or Assisted Living	Hubert Place		93 Canal Street	
	Lathrop Village		69 Lathrop Street	
	Loomis Village		20 Bayon Drive	
	Newton Manor		Newton Street	
	Wingate		573 Granby Road	
Churches	All Saints Episcopal Church		7 Woodbridge Street	
	Christ Life Fellowship Church		15 Lincoln Avenue	
	First Congregational Church		1 Church Street	
	Joshua Generation Fellowship		616 Amherst Road	
	Morning Start Baptist Church		11 North Main Street	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	New Life Presbyterian Church		411 Granby Road	
	Our Savior Lutheran Church		319 Granby Road	
	Second Baptist Church		589 Granby Road	
	St. Patrick Church		30 Main Street	
	St. Theresa Church		9 East Parkview Drive	
	Stony Brook Community Church		5 Ferry Street	
	United Methodist Church		30 Carew Street	
Apartment Complexes/Condos	Stoneybrook Village Condominiums		118 Stonybrook Way	
	Rivercrest Condominiums		20 Ferry Street	
	Jacob's Edge Condominiums		Rt. 202	
	Riverboat Village Apartments		173 Riverboat Village Drive	
	Falls Woods Condominiums		41 West Summit Street	
	Hillcrest Condominiums		Lawrence Avenue	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Pine Grove Condominiums		195 Pine Grove Drive	
	Hadley Village Condominiums		129 Hadley Village Road	
	Shadowbrook Condominiums		Shadowbrook Estates	
	Strong Farm Condominiums		North Main Street	
Economy	Village Commons		17 College Street	
	Big Y		433 Center Street	
Historic Buildings/Sites	Fire House Museum		4 North Main Street	
	South Hadley Canal Historic District (majority of canal is underwater)	Said to be the earliest navigable canal in the United States	North Main Street	
	The Sycamore/Rawson House		28 Woodbridge Street	
	Woodbridge Street Historic District		3, 7 Silver Street and 25-82 Woodbridge Street	
	South Hadley Falls Cemetery		Main Street	
	St. Rose Cemetery		Rte. 202 & 33	
	Notre Dame Cemetery		63 Lyman Street	

Facility Category	Name of Facility	Purpose/Notes	Address	Generator?
	Evergreen Cemetery		87 Hadley Street	

The table below lists critical facilities in high hazard areas. The Fire District #2 (backup EOC) and the Town Hall are each at risk to dam failure and flooding. This is one of the reasons that installing generators at these locations and other critical facilities is the highest priority in the list of mitigation actions.

Table 25 Critical Facilities in Hazard Areas

Hazards	Critical Facilities Impacted
Dam Failure	High hazard dams listed on DCR's registry The EOC and Town Hall could flood if the Holyoke Dam breaches
Drought	Whole planning area equally impacted.
Earthquake	Whole planning area equally impacted.
Extreme Temperatures	Whole planning area equally impacted.
Flood	The EOC and Town Hall could flood if the Holyoke Dam breaches
Hurricane	Whole planning area equally impacted.
Landslide	Landfill area
Severe Snowstorm/Ice Storm	Whole planning area equally impacted.
Severe Thunderstorm/Wind/Tornado	Whole planning area equally impacted.
Wildland Fire	Wooded portions of Town.

MITIGATION STRATEGY

The hazard mitigation strategy is the culmination of work presented in the previous sections of this plan. It is also the result of multiple Hazard Mitigation Committee meetings and public outreach.

CAPABILITY ASSESSMENT

The first step in the mitigation strategy portion of the 2016 Hazard Mitigation Plan Update process was to evaluate all of the Town's existing policies and practices related to natural hazards and identify potential gaps in protection. South Hadley's local Hazard Mitigation Committee worked with Ms. Caplan to complete the FEMA Capability Assessment worksheet. A summary of those findings is below.

Planning and Regulatory

South Hadley has a Master Plan in place as well as a Capital Improvements Plan and a Local Emergency Operations Plan. Transportation is covered in the Master Plan. The Town does not have a specific Stormwater Management Plan or a Wildlife Protection Plan. They adhere to current State level building codes. Their Zoning Ordinance covers floodplain management. They do have a specific Subdivision Ordinance and a Wetlands Protection plan. They have in the past purchased land for the purpose of open space and recreation.

Administrative and Technical

The South Hadley Planning Commission and Selectboard are the primary leadership groups within the Town. The Hazard Mitigation Committee was revived for the purposes of updating this plan. South Hadley has a fully staffed local government, including an Emergency Management Director, a Building Official, and a Planner. They do not have a civil engineer on staff. The Town relies on contract support and the PVPC for the majority of their Geographic Information System (GIS) needs. Within the Town of South Hadley are two Water Districts and Fire Districts. Those districts maintain Memorandum's of Understanding (MOUs) with bordering communities. They use a reverse 911 system to warn Town residents of impending disasters.

Financial

The Town is sound financially. They have received Community Development Block Grant Funding as well as other State and Federal funding in the past. They maintain a Capital Improvements funding budget.

Education and Outreach

In terms of education and outreach the Town, as well as the Fire and Water Districts are working on educating their constituents about hazard mitigation and preparedness. The Fire Districts have a relationship with the School Department and provide education services on a regular basis. The Public Health Administrator is also actively involved in education and outreach. The Town website includes mitigation and preparedness information.

Agencies That Have the Authority to Regulate Development

The Planning Board is the primary Town agency responsible for regulating development in town. Feedback to the Planning Board was ensured through the participation of the Town's planner on the Hazard Mitigation Committee. In addition, the Pioneer Valley Planning Commission, as a regional planning authority, works with all agencies that regulate development in South Hadley, including the municipal entities listed above and state agencies, such as Department of Conservation and Recreation and MassDOT. This regular involvement ensured that during the development of the 2016 Hazard Mitigation Plan Update, the operational policies and any mitigation strategies or identified hazards from these entities were incorporated into the 2016 Hazard Mitigation Plan Update.

For the extent of this analysis, PVPC and the Hazard Mitigation Committee reviewed the following Town documents:

- Zoning Bylaws
- Subdivision Rules and Regulations
- Comprehensive Emergency Management Plan
- Town Open Space and Recreation Plan

Table 26 Mitigation Capabilities

Existing Mitigation Capabilities				
Capability	Action Type	Description	Hazards Mitigated	Effectiveness
Flood Control Structures	Capital Construction	There are thirteen (13) dams in South Hadley	Flooding	Effective
Site Plan Review	Zoning Bylaws	Site Plan Review requires measures to reduce runoff and potential for flooding	Flooding	Effective
Flood Plain Regulations	Regulations	Areas delineated as part of the 100-year flood plain are protected by strict use regulations	Flooding	Effective
Flexible Development	Operational Strategy	Flexibility in defining dimensional standards and density for residential developments	Flooding	Effective
Definitive Plan for Subdivision	Subdivision Regulations	Requires a Definitive Plan for new subdivisions, including location of all wetlands, flood plains and proposed storm drainage	Flooding	Effective
Development Impact Statement	Subdivision Regulations	Requires a Development Impact Statement (DIS) detailing the impacts of the subdivision on surface water and subsurface conditions	Flooding	Effective
Compliance with Zoning Bylaw	Subdivision Regulations	Requires compliance with Zoning Bylaw including Floodplain Regulations	Flooding	Effective
Water Supply Protection District	Zoning bylaws	Areas delineated as primary recharge areas for groundwater aquifers, and watershed areas for reservoirs are protected by strict use regulations. Provisions to control soil erosion.	Flooding	Effective
Design Standards for Roads	Subdivision Regulations	Standards include street grade regulations (4 to 9 percent maximum)	Severe Snowstorms / Ice Storms	Effective

Existing Mitigation Capabilities				
Capability	Action Type	Description	Hazards Mitigated	Effectiveness
South Hadley Open Space and Recreation Plan	Planning Document	Inventories natural features and promotes natural resource preservation in the Town, including areas in the floodplain; such as wetlands aquifer recharge areas, farms and open space, rivers, streams and brooks.	Floods Severe Thunderstorm Hurricanes Tornadoes Wildfire / Brushfire Earthquakes Dam Failure	Effective
Participation in the National Flood Insurance Program	Operational Strategy	As of 2006, there were 62 homeowners with flood insurance policies	Flooding	Effective
State Building Code	State regulation	The Town of South Hadley has adopted the Massachusetts State Building Code which promotes construction of buildings that can withstand hazards to a certain degree	Floods Severe Snowstorms / Ice Storms Severe Thunderstorm Hurricanes Tornadoes Wildfire / Brushfire Earthquakes Dam Failure	Effective
Zoning Regulations for Telecommunications Facilities	Zoning bylaws	Provides for placing wireless communications facilities in locations without negative impacts on safety	Flooding Severe Snowstorms / Ice Storms Severe Thunderstorm Hurricanes Tornadoes Earthquakes	Effective

Existing Mitigation Capabilities				
Capability	Action Type	Description	Hazards Mitigated	Effectiveness
Utilities	Subdivision Regulations	Electric, cable, communications, and gas utility lines are to be placed underground in new subdivisions	Severe Snowstorms / Ice Storms Severe Thunderstorms Hurricanes Tornadoes	Effective
Burn Permits	Regulation	Requires Fire District #1 notification. Burn Permits issued through Building Department	Wildfire / Brushfire	Effective
Public Education / Outreach	Operational Strategy	The Fire Department has an ongoing educational program in the schools	Wildfire / Brushfire	Effective
New Dam Construction Permits	Regulation	State law requires a permit for the construction of any dam	Flooding Dam Failure	Effective
Dam Inspections	Operational Strategy	DCR has an inspection schedule that is based on the hazard rating of the dam (low, medium, high hazard)	Flooding Dam Failure	Effective
Mobile Homes	Zoning Bylaw	Mobile homes are an allowed use in all districts. Does not address the potential for wind-related damage to mobile homes	Hurricanes Tornadoes	Ineffective

In summary, the Town of South Hadley has proven they are aware of potential risks to natural hazards and mitigate them with multiple planning and land use systems. As a community made up of Town Government as well as two Fire and Water Districts they came together to actively work on updating this 2016 Hazard Mitigation Plan Update. During a Hazard Mitigation Committee meeting, the question of emergency access on River Road through conservation land and private property came up. The Committee members worked together following the meeting to visit the location, consult with the Conservation Department and Town Attorneys to develop a solution. They are committed as well as capable of mitigating risk. As a small Town they rely on Mutual Aid Agreements with MEMA and with surrounding communities to respond to disasters. They actively participate with the PVPC and take advantage of their no cost technical assistance by PVPC's professional planning staff.

South Hadley needs hazard mitigation funding to implement their prioritized actions. The Town itself is fiscally sound, however they are limited in the amount of money they can raise on their own. The Town is capable and committed to matching HMGP grant funding.

MITIGATION STRATEGY

After reviewing existing policies and the hazard identification and risk assessment, the Town Hazard Mitigation Committee developed a set of hazard mitigation strategies it would like to implement.

The Hazard Mitigation Committee reviewed the 2007 Mitigation Plan goal statement:

To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to the following hazards: flooding, severe snowstorms/ice storms, severe thunderstorms, hurricanes, tornadoes, wildfires/brushfires, earthquakes, dam failures, and drought.

They decided to amend their goal statement to reflect all natural hazards. The previous statement limits the Town by opening the possibility that they are mitigating only the hazards named in the goal statement.

The 2016 Hazard Mitigation Plan Update goal statement is below.

To reduce or eliminate the loss of life, property and government disruption to all natural hazards.

2007 Mitigation Action Status

After agreeing upon a goal statement, the Hazard Mitigation Committee reviewed the mitigation actions in the 2007 plan. Several mitigation strategies listed in the 2007 version of the South Hadley Hazard Mitigation Plan have been completed or removed in this 5-year update. Strategies were deleted for one of two reasons: 1) they have been determined as no longer useful for mitigating a hazard. 2) They have been determined to be over generalized and in need of being replaced by a more specific mitigation strategy.

The table below is taken from the 2007 Hazard Mitigation Plan. The shaded rows indicate that the mitigation action has been completed. Each mitigation action includes a brief description regarding its

current status. Some of the mitigation actions, those indicated, have moved forwarded into this 2016 Hazard Mitigation Plan Update.

Table 27 Analysis of 2007 Mitigation Actions

MITIGATION ACTION	RESPONSIBLE DEPARTMENT/BOARD	PROPOSED COMPLETION DATE	PRIORITY	2016 STATUS
Establish a Local Emergency Management Planning Committee (LEPC)	Selectboard	2007	High	South Hadley participates in the Regional Emergency Planning Committee so they don't have a need for a local committee.
Support Emergency Management Director to perform duties	Selectboard, LEPC	2007+	High	Sharon Hart the Emergency Management Director is recognized and well supported.
Inventory Supplies at existing shelters and develop a needs list of storage requirements. Establish arrangements with local or neighboring vendors to supply shelters with food and first aid supplies in the event of a natural disaster.	Emergency Management Director	2007	High	Several participants in the January 28, 2016 Hazard Mitigation Committee meeting mentioned that this action has been completed. The Plains School is not officially recognized as a shelter by the American Red Cross, although it may become a recognized shelter and it does have essential supplies in place.
Establish backup power at Emergency Operation Centers	Selectboard, LEPC	2007	High	The South Hadley Police Department become the primary EOC because it has a generator. Each of the back-up locations also have generators.
Collect, periodically update, and disseminate information on which local radio stations provide emergency information, what to include in a "home survival kit", how to prepare homes and other structures to withstand flooding and high winds, and the proper evacuation procedures to follow during a natural disaster.	LEPC, Board of Health	2008	High	This activity has been done and continues to be implemented. In addition, the South Hadley website has been updated with emergency information.
Ensure the Development Impact Statement identifies impacts of the proposed development for flooding and include mitigation measures if deemed necessary by the Planning Board.	Planning Board	2008	High	This mitigation action is not considered relevant and will be removed from the mitigation plan.
Implement the Erosion and Sediment Control Bylaw compliant with NPDES Phase II.	Planning Board, Conservation Commission, DPW	2008	High	Have adopted a stormwater bylaw and will revisit it when new stormwater regulations come out.

MITIGATION ACTION	RESPONSIBLE DEPARTMENT/BOARD	PROPOSED COMPLETION DATE	PRIORITY	2016 STATUS
Town should evaluate whether to become part of FEMA's Community Rating System	Selectboard, LEPC	2008	Medium	This measure will move forward with a slight change. The Town is not in a position to independently adopt the CRS however, they would become part of a regional effort.
Develop a beaver management strategy	Board of Health, conservation commission, Fire Department	2008	Low	A beaver management plan is in place. If necessary beavers are trapped and moved, if moving a beaver when it isn't trapping season then an emergency permit is issued to trap the beaver.
Comprehensive evacuation plans are required for High Hazard Dams and ensure the safety of citizens in the event of dam failure	BOS, Planning Board, EMD	2007	High	Part of Dam Safety report.
Seek funding to replace undersized culverts that lead to collection of debris and localized flooding	Selectboard, DPW	2008+	High	This action needs to move forward with some additional detail regarding specific culverts.
Coordinate with owner of Holyoke Dam to better regulate flood control boards to prevent flooding on River Road	Holyoke Gas and Electric, DPW, conservation Commission, Selectboard	2008	High	New baffles and flood control measures are in place. Coordination with the owner of the dam is ongoing. However, there is a limit to the amount of flood control measures the dam can use to control flooding on River Road. Additional flood control mitigation actions for River Road have been added to this plan.
Establish a Red Cross approved shelter	LEPC	2007	High	American Red Cross has approved a couple of shelters in South Hadley.
Purchase and install backup generator at Fire District #2 headquarters	Selectboard, Fire District #2, LEPC	2007	High	The generator in place is 40 years old. It works but should be replaced because if it fails parts are not readily available to fix it.
Consider participation in a regional Debris Management Plan	Selectboard, Planning Board, LEPC	2008	Medium	South Hadley is still interested in participating in a regional effort to develop a Debris Management Plan.
Develop a voluntary home fire and safety inspection program	Fire Districts #1 and #2	2008	Medium	This program has been implemented. The Fire Chiefs would like to add additional mitigation actions related to fire safety.

MITIGATION ACTION	RESPONSIBLE DEPARTMENT/BOARD	PROPOSED COMPLETION DATE	PRIORITY	2016 STATUS
Establish better coordination between Building Departments and Fire Districts about burn permit issuance and notification	Building Inspector, Forest Warden, Fire Districts #1 and #2	2008	Medium	Both fire districts adhere to DEP and Fire Code regulations.
Evaluate emergency shelters to determine if they are earthquake resistant	Building Inspector, Emergency Management Director	2007	High	All of the approved shelters are considered earthquake resistant.
Ensure that all identified shelters have sufficient backup utility service in the event of primary power failure	LEPC	2007	High	All of the shelters have backup generators in place.
Identify sources of funding for dam safety inspections	LEPC	2007+	Medium	Dam safety regulations are enforced through DCR.
Develop a Water Conservation Plan	Water Departments	2009	Low	Both districts have water conservation plans.
Work with the utility companies to underground new utility lines in general and existing lines in locations where repetitive outages occur	Mayor, Town Council, Planning Board	2007	Medium	Over the last ten years the majority of new developments have been placed underground. At the current time, the South Hadley Electric Light Department and the Hazard Mitigation Committee do not see a need to underground lines currently above ground.
Consider prohibiting any hazardous materials within the Water Supply Protection District	Planning Board, Water Department	2009	Low	Covered by current plan and regulations.
Add definition for "petroleum products" to definition section of Zoning Bylaw	Planning Board	2008	Low	No longer relevant.
Add performance standards to the Water Supply Protection District Zoning for the storage of petroleum products including automated spill/leak detection and fuel delivery identifier systems to prevent overflow.	Planning Board	2008	Low	Covered by current plan and regulations.
Require businesses using and storing hazardous materials to keep a set of Material Safety Data	Emergency Management	2008	Medium	Covered by current plan and regulations.

MITIGATION ACTION	RESPONSIBLE DEPARTMENT/BOARD	PROPOSED COMPLETION DATE	PRIORITY	2016 STATUS
Sheets (MSDS) in a lock box on the outside of the building and provide access to Emergency Management Director	Director			

Mitigation Actions by Hazard

After a review of the previous plan, the Hazard Mitigation Committee considered the natural hazards the Town faces a risk from and considered possible ways to mitigate those risks. A general overview of the concepts underlying mitigation strategies for each of the hazards identified in this plan is as follows:

Dam Failure

Dam failure is a highly infrequent occurrence, but a severe incident could prove catastrophic. In addition, dam failure most often coincides with flooding, so its impacts can be multiplied, as the additional water has nowhere to flow. The only mitigation measures currently in place are the state regulations governing the construction, inspection, and maintenance of dams. This is managed through the Office of Dam Safety at the Department of Conservation and Recreation.

Drought

Although Massachusetts does not face extreme droughts like many other places in the country, it is susceptible to dry spells and drought. Drought can most likely be effectively mitigated in regions like the Pioneer Valley if measures are put into place, such as ensuring that groundwater is recharged.

Earthquakes

Although there are five mapped seismological faults in Massachusetts, there is no discernible pattern of previous earthquakes along these faults nor is there a reliable way to predict future earthquakes along these faults or in any other areas of the state. Consequently, earthquakes are arguably the most difficult natural hazard for which to plan.

Most buildings and structures in the state were constructed without specific earthquake resistant design features. In addition, earthquakes precipitate several potential devastating secondary effects such as building collapse, utility pipeline rupture, water contamination, and extended power outages. Therefore, many of the mitigation efforts for other natural hazards identified in this plan may be applicable during the Town's recovery from an earthquake.

Extreme Temperatures

Extreme temperatures include extreme heat as well as extreme cold and each poses threats to the population. The best way to mitigate the risk of extreme temperatures is to prepare buildings to withstand the extreme. In terms of heat this means air conditioning, in terms of cold this means building insulation and heating. Each may require generators to insure an improved environment can be maintained. Increasing awareness of temperature extremes and their safety risks may improve public health. Educating homeowners about property maintenance and freezing pipes may reduce the impact of extreme cold. Vulnerable populations must be considered due to their susceptibility to succumb to extreme temperatures.

Floods

he key factors in flooding are the water capacity of water bodies and waterways, the regulation of waterways by flood control structures, and the preservation of flood storage areas and wetlands. As

more land is developed, more flood storage is demanded of the town's water bodies and waterways. The Town currently addresses this problem with a variety of mitigation tools and strategies. Flood-related regulations and strategies are included in the Town's general bylaws, zoning by-law, and subdivision regulations. Infrastructure like dams and culverts are in place to manage the flow of water.

Hurricanes

Hurricanes provide the most lead warning time of all identified hazards, because of the relative ease in predicting the storm's track and potential landfall. MEMA assumes "standby status" when a hurricane's location is 35 degrees North Latitude (Cape Hatteras) and "alert status" when the storm reaches 40 degrees North Latitude (Long Island). Even with significant warning, hurricanes can do significant damage – both due to flooding and severe wind.

The flooding associated with hurricanes can be a major source of damage to buildings, infrastructure and a potential threat to human lives. Flood protection measures can thus also be considered hurricane mitigation measures. The high winds that often accompany hurricanes can also damage buildings and infrastructure, similar to tornadoes and other strong wind events.

Landslides

Landslides may move massive amounts of rock, soil and debris with tremendous force. Stabilizing steep slopes prone to slides may be the best mitigation action. In addition, managing development in areas prone to landslide prevents their impacting infrastructures and facilities.

Severe Snowstorms/Ice Storms

Winter storms can be especially challenging for emergency management personnel. The Massachusetts Emergency Management Agency (MEMA) serves as the primary coordinating entity in the statewide management of all types of winter storms and monitors the National Weather Service (NWS) alerting systems during periods when winter storms are expected. Even though the storm has usually been forecast, there is no certain way for predicting its length, size or severity. Therefore, mitigation strategies must focus on preparedness prior to a severe snow/ice storm.

The Town's current mitigation tools and strategies focus on preparedness, with many regulations and standards established based on safety during storm events. To the extent that some of the damages from a winter storm can be caused by flooding, flood protection mitigation measures also assist with severe snowstorms and ice storms.

Severe Thunderstorms/Wind/Tornadoes

Most damage from tornadoes and severe thunderstorms come from high winds that can fell trees and electrical wires, generate hurtling debris and, possibly, hail. According to the Institute for Business and Home Safety, the wind speeds in most tornadoes are at or below design speeds that are used in current building codes, making strict adherence to building codes a primary mitigation strategy. In addition, current land development regulations, such as restrictions on the height of telecommunications towers, can also help prevent wind damages.

Wildfire/Brush Fire

Wildfire and brushfire mitigation strategies involve educating people about how to prevent fires from starting, as well as controlling burns within the town.

2016 Hazard Mitigation Actions

The Hazard Mitigation Committee developed a list of mitigation actions based on the need for mitigation actions to address current and future hazards. Several of the action items previously identified in the 2007 Hazard Mitigation Plan are currently continuing, either because they require more time to secure funding or their construction process is ongoing. The new mitigation actions are based on experience with currently implemented actions, as well as the hazard identification and risk assessment in this plan.

The table below identifies all of the mitigation actions for this plan. As the Hazard Mitigation Committee discussed each mitigation action, they identified a responsible party or agency responsible for securing funding and implementing the mitigation action. Many of the mitigation actions require a collaborative effort as indicated by the listing of several departments or organizations. They also identified potential funding sources, also indicated in the table below. Finally, the Hazard Mitigation Committee sought to mitigate risk to all of the hazards the Town may experience so the list of hazards that each mitigation action addresses is included. Several actions are considered relevant to “all hazards” and are so indicated.

The mitigation actions are listed in priority order. This order was developed by the Hazard Mitigation Committee. The Town of South Hadley recognizes that projects may be implemented in the order they are funded, not necessarily in the order of priority. The following categories are used to define the priority of each mitigation strategy:

Very High – extremely beneficial projects that will greatly contribute to mitigation of multiple hazards and the protection of people and property. These projects are also given a numeric ranking within the category.

High – Strategies that provide mitigation of several hazards and have a large benefit that warrants their cost and time to complete.

Medium – Strategies that would have some benefit to people and property and are somewhat cost effective at reducing damage to property and people.

Low – Strategies that would not have a significant benefit to property or people, address only one or two hazards, or would require funding and time resources that are impractical.

These categories were developed utilizing the following criteria:

Application to multiple hazards – Strategies are given a higher priority if they assist in the mitigation of several natural hazards.

Time required for completion – Projects that are faster to implement, either due to the nature of the permitting process or other regulatory procedures, or because of the time it takes to secure funding, are given higher priority.

Estimated benefit – Strategies which would provide the highest degree of reduction in loss of property and life are given a higher priority. This estimate is based on the Hazard Identification and Analysis Chapter, particularly with regard to how much of each hazard's impact would be mitigated.

Cost effectiveness – in order to maximize the effect of mitigation efforts using limited funds, priority is given to low-cost strategies. For example, regular tree maintenance is a relatively low-cost operational strategy that can significantly reduce the length of time of power outages during a winter storm. Strategies that have identified potential funding streams, such as the Hazard Mitigation Grant Program, are also given higher priority.

Eligibility Under Hazard Mitigation Grant Program – The Hazard Mitigation Grant Program (HMGP) provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Funding is made available through FEMA by the Massachusetts Emergency Management Agency. Municipalities apply for grants to fund specific mitigation projects under MEMA requirements

In addition to the priority order, a projected completion date was given for each mitigation action. It is difficult to estimate a start date for each mitigation action because several actions can only begin when funding is secured. However, the Hazard Mitigation Committee considered the length of time it takes to secure funding when estimating the target completion date for each action.

Finally, the estimated cost of each mitigation action is included. The exact cost of mitigation actions was not identified, for this reason the following cost range was developed, Low represents projects under \$25,000, Medium represents projects between \$25 - \$50,000 and High represents projects over \$50,000.

Table 28 2016 Hazard Mitigation Actions

PRIORITY ORDER	MITIGATION ACTION	HAZARDS ADDRESSED	RESPONSIBLE DEPARTMENT/B OARD	POTENTIAL FUNDING SOURCE(S)	ESTIMATED COST	PROPOSED COMPLETION DATE
High #1	Purchase and install generators at the following critical facilities: Fire District #2 (Backup EOC), Middle School, Town Hall and the Mosier School.	All hazards	District #2	Town, State, District #2	High	March 2016 - March 2018
High #2	Add a dry hydrant on River Road and Tigger Lane where the water main ends	Drought Extreme Temperatures Wildfire/Brush Fire Severe Thunderstorms/ Wind/Tornadoes	District #1	District #1, Town, FEMA Grant	Low	March 2016 - March 2021
High #3	Evaluate and then if deemed feasible re-establish emergency access route on River Road (gates need to be on conservation land)	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	District #1, DPW, Conservation	Town, Districts #1 and #2	Medium	March 2016 - March 2019
High #4	If warranted, raise the road, and replace the culvert and water main on Pearl Street to avoid flooding and the need to evacuate homes	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	DPW, District #2	DPW Chapter 90 Funds, District #2, FEMA and/or State Grant	High	April 2017 - March 2021
High #5	If deemed cost effected and beneficial, implement mitigation measures identified to mitigate flooding on River Road.	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	DPW	DPW Chapter 90 Funds	High	April 2018 - March 2021
Medium	Evaluate cost effectiveness of raising the road, and replacing the culvert and water main on Pearl Street to avoid flooding and the need to evacuate homes	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	DPW, District #2	DPW Chapter 90 Funds, District #2, FEMA	Low	April 2016 - March 2021

PRIORITY ORDER	MITIGATION ACTION	HAZARDS ADDRESSED	RESPONSIBLE DEPARTMENT/B OARD	POTENTIAL FUNDING SOURCE(S)	ESTIMATED COST	PROPOSED COMPLETION DATE
				and/or State Grant		
Medium	Conduct a flood study to determine the best solution to mitigate flooding on River Road. If necessary replace the culvert on River Road.	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	DPW	DPW Chapter 90 Funds	Low	April 2017 - March 2021
Medium	Invite Mount Holyoke College to join in Town emergency management planning efforts.	All hazards	EMD Director	Town	Low	March 2016 - March 2017
Medium	Conduct table-top exercises in collaboration with Mount Holyoke College on an annual basis	All hazards	EMD Director	Town	Low	April 2017 - March 2021
Low	Develop oversight strategy to ensure that retention ponds and detention basins are maintained by appropriate agency	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	Planning Board, Conservation Department, DPW	Town	Low	April 2016 - March 2021
Low	Town should evaluate whether to become part of FEMA's Community Rating System	Floods	Selectboard, LEPC	State	Low	May 2019 - March 2021
Low	Continue to monitor and maintain culverts that collect debris and may cause localized flooding. Identify those that may need replacing.	Floods Hurricanes Severe Thunderstorms/ Wind/Tornadoes	Selectboard, DPW	DPW Chapter 90 funds	Low	March 2016 - March 2021
Low	Consider participation in a regional Debris Management Plan	All hazards	Selectboard, Emergency Management Director	State	Medium	June 2017 - March 2021

FEMA Grant Funding Sources

FEMA has three grant funding sources for mitigation actions.

Hazard Mitigation Grant Program (HMGP)

“The purpose of the HMGP program is to help communities implement hazard mitigation measures following a Presidential major disaster declaration. Hazard mitigation is any action taken to reduce or eliminate long term risk to people and property from natural hazards. The HMGP is authorized under [Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act](#).”⁹

Pre-Disaster Mitigation (PDM)

“The PDM Program, authorized by Section 203 of the [Robert T. Stafford Disaster Relief and Emergency Assistance Act](#), is designed to assist States, territories, Federally-recognized tribes, and local communities in implementing a sustained pre-disaster natural hazard mitigation program. The goal is to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters. This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis.”¹⁰

Flood Mitigation Assistance (FMA)

“The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to States, Territories, federally-recognized tribes and local communities for projects that reduce or eliminate long-term risk of flood damage to structures insured under the NFIP. FMA funding is available for flood hazard mitigation projects, plan development and management costs. Funding is appropriated by Congress annually.”¹¹

⁹ <http://www.fema.gov/hazard-mitigation-grant-program> Accessed on February 27, 2016.

¹⁰ <https://www.fema.gov/pre-disaster-mitigation-grant-program> Accessed on February 27, 2016.

¹¹ <https://www.fema.gov/flood-mitigation-assistance-grant-program> Accessed on February 27, 2016.

PLAN review, evaluation, implementation, and adoption

Plan Adoption

Upon completion of the draft 2016 Hazard Mitigation Plan Update, a public meeting was held by the Hazard Mitigation Committee to present and request comments from town officials and residents. Then a two-week comment period was available for the public as well as town officials to review the plan. The 2016 Hazard Mitigation Plan Update was then submitted to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency for their review. Upon receiving conditional approval of the plan by FEMA, the plan **was presented to the Town's Select Board and adopted.**

Plan Implementation

The implementation of this plan began upon its formal adoption by the Town Select Board and approval by MEMA and FEMA. Those town departments and boards responsible for ensuring the development of policies, bylaw revisions, and programs as described in the Mitigation Strategy of this plan will be notified of their responsibilities immediately following approval. The Town's Hazard Mitigation Committee, led by the Emergency Management Director will oversee the implementation of the plan.

Incorporation with Other Planning Documents

Existing plans, studies, reports and municipal documents were incorporated throughout the planning process. This included a review and incorporation of significant information from the following key documents:

- ***Comprehensive Emergency Management Plan*** (particularly the Critical Infrastructure Section) – the Critical Infrastructure section was used to identify those infrastructure components that have been identified as crucial to the function of the town; also, this resource was used to identify special needs populations as well as potential emergency shortcomings.
- ***Open Space, Recreation Plan*** this Plan was used to identify the natural context within which the town mitigation planning would take place. This proved useful insofar as it identified water bodies, rivers, streams, infrastructure components (i.e. water and sewer, or the lack thereof), as well as population trends. This was incorporated to ensure that the Town's mitigation efforts would be sensitive to the surrounding environment.
- ***Zoning Ordinance*** –Zoning was used to gather identify those actions that the town is already taking that are reducing the potential impacts of a natural hazard (i.e. floodplain regulations) to avoid duplicating existing successful efforts.
- ***Massachusetts' State Hazard Mitigation Plan*** - This plan was used to insure that the town's HMP was consistent with the State's Plan.

After this plan has been approved by both FEMA and the local government, links to the plan will be emailed to all Town staff, boards, and committees, with a reminder to review the plan periodically and work to incorporate its contents, especially the action plan, into other planning processes and documents. In addition, during annual monitoring meetings for the Hazard Mitigation Plan implementation process, the Hazard Mitigation Committee will review whether any of these plans are in the process of being updated. If so, the Hazard Mitigation Committee will remind people working on these plans, policies etc. of the 2016 Hazard Mitigation Plan Update, and urge them to incorporate the plan into their efforts. The Hazard Mitigation Committee will also review current Town programs and policies to ensure that they are consistent with the mitigation strategies described in this plan. The Hazard Mitigation Plan will also be incorporated into updates of the Town's Comprehensive Emergency Management Plan.

Plan Monitoring and Evaluation

The Town's Emergency Management Director will call meetings of all responsible parties to review plan progress on an annual basis in each of the following years: 2017, 2018, 2019, 2020, and as needed (*i.e.*, following a natural disaster). The public will be notified of these meetings in advance through a posting of the agenda at Town Hall. Responsible parties identified for specific mitigation actions will be asked to submit their reports in advance of the meeting. Meetings will entail the following actions:

- Review events of the year to discuss and evaluate major issues, effectiveness of current mitigation, and possible mitigation for future events.
- Assess how the mitigation strategies of the plan can be integrated with other Town plans and operational procedures, including the Zoning Bylaw and Emergency Management Plan.
- Review and evaluate progress toward implementation of the current mitigation plan based on reports from responsible parties.
- Amend current plan to improve mitigation practices.

Following these discussions, it is anticipated that the committee may decide to reassign the roles and responsibilities for implementing mitigation strategies to different town departments and/or revise the goals and objectives contained in the plan. The committee will review and update the Hazard Mitigation Plan every five years. The next updated plan will be submitted to MEMA and FEMA in the spring of 2021.

The Town's Emergency Management Director will call meetings of all responsible parties to review plan progress as needed, based on occurrence of hazard events. The public will be notified of these meetings in advance through a posting of the agenda at Town Hall. Responsible parties identified for specific mitigation actions will be asked to submit their reports in advance of the meeting.

Meetings will involve evaluation and assessment of the plan, regarding its effectiveness at achieving the plan's goals and stated purpose. The following questions will serve as the criteria that is used to evaluate the plan:

Plan Mission and Goal

- Is the Plan's stated goal and mission still accurate and up to date, reflecting any changes to local hazard mitigation activities?
- Are there any changes or improvements that can be made to the goal and mission?

Hazard Identification and Risk Assessment

- Have there been any new occurrences of hazard events since the plan was last reviewed? If so, these hazards should be incorporated into the Hazard Identification and Risk Assessment.
- Have any new occurrences of hazards varied from previous occurrences in terms of their extent or impact? If so, the stated impact, extent, probability of future occurrence, or overall assessment of risk and vulnerability should be edited to reflect these changes.
- Is there any new data available from local, state, or Federal sources about the impact of previous hazard events, or any new data for the probability of future occurrences? If so, this information should be incorporated into the plan.

Existing Mitigation Strategies

- Are the current strategies effectively mitigating the effect of any recent hazard events?
- Has there been any damage to property since the plan was last reviewed?
- How could the existing mitigation strategies be improved upon to reduce the impact from recent occurrences of hazards? If there are improvements, these should be incorporated into the plan.

Proposed Mitigation Strategies

- What progress has been accomplished for each of the previously identified proposed mitigation strategies?
- How have any recently completed mitigation strategies affected the Town's vulnerability and impact from hazards that have occurred since the strategy was completed?
- Should the criteria for prioritizing the proposed mitigation strategies be altered in any way?
- Should the priority given to individual mitigation strategies be changed, based on any recent changes to financial and staffing resources, or recent hazard events?

Review of the Plan and Integration with Other Planning Documents

- Is the current process for reviewing the Hazard Mitigation Plan effective? Could it be improved?
- Are there any Town plans in the process of being updated that should have the content of this Hazard Mitigation Plan incorporated into them?

- How can the current Hazard Mitigation Plan be better integrated with other Town planning tools and operational procedures, including the zoning bylaw, the Comprehensive Emergency Management Plan, and the Capital Improvement Plan?

Following these discussions, it is anticipated that the committee may decide to reassign the roles and responsibilities for implementing mitigation strategies to different town departments and/or revise the goals and objectives contained in the plan. The committee will review and update the Hazard Mitigation Plan every five years.

Public participation will be a critical component of the Hazard Mitigation Plan maintenance process. The Hazard Mitigation Committee will hold all meetings in accordance with Massachusetts open meeting laws and the public invited to attend. The public will be notified of any changes to the Plan via the meeting notices board at Town Hall, and copies of the revised Plan will be made available to the public at Town Hall.

7: APPENDICES

APPENDIX A – TECHNICAL RESOURCES

Agencies

Massachusetts Emergency Management Agency (MEMA).....	508/820-2000
Hazard Mitigation Section	617/626-1356
Federal Emergency Management Agency (FEMA)	617/223-4175
MA Regional Planning Commissions:	
Berkshire Regional Planning Commission (BRPC).....	413/442-1521
Cape Cod Commission (CCC).....	508/362-3828
Central Massachusetts Regional Planning Commission (CMRPC).....	508/693-3453
Franklin Regional Council of Governments (FRCOG).....	413/774-3167
Martha's Vineyard Commission (MVC).....	508/693-3453
Merrimack Valley Planning Commission (MVPC).....	978/374-0519
Metropolitan Area Planning Council (MAPC).....	617/451-2770
Montachusett Regional Planning Commission (MRPC).....	978/345-7376
Nantucket Planning and Economic Development Commission (NP&EDC).....	508/228-7236
Northern Middlesex Council of Governments (NMCOG).....	978/454-8021
Old Colony Planning Council (OCPC).....	508/583-1833
Pioneer Valley Planning Commission (PVPC).....	413/781-6045
Southeastern Regional Planning and Economic Development District (SRPED).....	508/823-1803
MA Board of Building Regulations & Standards (BBRS).....	617/227-1754
MA Coastal Zone Management (CZM).....	617/626-1200
DCR Water Supply Protection.....	617/626-1379
DCR Waterways.....	617/626-1371
DCR Office of Dam Safety.....	508/792-7716
DFW Riverways.....	617/626-1540
MA Dept. of Housing & Community Development.....	617/573-1100
Woods Hole Oceanographic Institute.....	508/457-2180
UMass-Amherst Cooperative Extension.....	413/545-4800
National Fire Protection Association (NFPA).....	617/770-3000
New England Disaster Recovery Information X-Change (NEDRIX – an association of private companies & industries involved in disaster recovery planning).....	781/485-0279
MA Board of Library Commissioners.....	617/725-1860
MA Highway Dept, District 2.....	413/582-0599
MA Division of Marine Fisheries.....	617/626-1520
MA Division of Capital & Asset Management (DCAM).....	617/727-4050
University of Massachusetts/Amherst.....	413/545-0111
Natural Resources Conservation Services (NRCS).....	413/253-4350
MA Historical Commission.....	617/727-8470
U.S. Army Corps of Engineers.....	978/318-8502
Northeast States Emergency Consortium, Inc. (NESEC).....	781/224-9876
National Oceanic and Atmospheric Administration: National Weather Service.....	508/824-5116

US Department of the Interior: US Fish and Wildlife Service	413/253-8200
US Geological Survey.....	508/490-5000

Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP)	MA Emergency Management Agency
406 Public Assistance and Hazard Mitigation	MA Emergency Management Agency
Community Development Block Grant (CDBG).....	DHCD, also refer to RPC
Dam Safety Program.....	MA Division of Conservation and Recreation
Disaster Preparedness Improvement Grant (DPIG)	MA Emergency Management Agency
Emergency Generators Program by NESEC†	MA Emergency Management Agency
Emergency Watershed Protection (EWP) Program.....	USDA, Natural Resources Conservation
Service Flood Mitigation Assistance Program (FMAP).....	MA Emergency Management Agency
Flood Plain Management Services (FPMS).....	US Army Corps of Engineers
Mitigation Assistance Planning (MAP).....	MA Emergency Management Agency
Mutual Aid for Public Work.....	Western Massachusetts Regional Homeland Security Advisory Council
National Flood Insurance Program (NFIP) †	MA Emergency Management Agency
Power of Prevention Grant by NESEC†	MA Emergency Management Agency
Roadway Repair & Maintenance Program(s).....	Massachusetts Highway Department
Section 14 Emergency Stream Bank Erosion & Shoreline Protection	US Army Corps of Engineers
Section 103 Beach Erosion.....	US Army Corps of Engineers
Section 205 Flood Damage Reduction.....	US Army Corps of Engineers
Section 208 Snagging and Clearing	US Army Corps of Engineers
Shoreline Protection Program.....	MA Department of Conservation and Recreation
Various Forest and Lands Program(s).....	MA Department of Environmental Protection
Wetlands Programs	MA Department of Environmental Protection

†NESEC – Northeast States Emergency Consortium, Inc. is a 501(c)(3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NESEC for more information.

† Note regarding National Flood Insurance Program (NFIP) and Community Rating System (CRS): The National Flood Insurance Program has developed suggested floodplain management activities for those communities who wish to more thoroughly manage or reduce the impact of flooding in their jurisdiction. Through use of a rating system (CRS rating), a community's floodplain management efforts can be evaluated for effectiveness. The rating, which indicates an above average floodplain management effort, is then factored into the premium cost for flood insurance policies sold in the community. The higher the rating achieved in that community, the greater the reduction in flood insurance premium costs for local property owners. MEMA can provide additional information regarding participation in the NFIP-CRS Program.

Internet Resources

Sponsor	Internet Address	Summary of Contents
Natural Hazards Research Center, U. of Colorado	http://www.colorado.edu/litbase/hazards/	Searchable database of references and links to many disaster-related websites.
Atlantic Hurricane Tracking Data by Year	http://wxe.eas.purdue.edu/hurricane	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	http://nemaweb.org	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center “Disaster Finder:	http://www.gsfc.nasa.gov/ndrd/disaster/	Searchable database of sites that encompass a wide range of natural disasters.
NASA Natural Disaster Reference Database	http://ltpwww.gsfc.nasa.gov/ndrd/main/html	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	http://www.statelocal.gov/	General information through the federal-state partnership.
National Weather Service	http://nws.noaa.gov/	Central page for National Weather Warnings, updated every 60 seconds.
USGS Real Time Hydrologic Data	http://h2o.usgs.gov/public/realtime.html	Provisional hydrological data
Dartmouth Flood Observatory	http://www.dartmouth.edu/artsci/geog/floods/	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	http://www.fema.gov/fema/csb.html	Searchable site for access of Community Status Books
Florida State University Atlantic Hurricane Site	http://www.met.fsu.edu/explores/tropical.html	Tracking and NWS warnings for Atlantic Hurricanes and other links

Sponsor	Internet Address	Summary of Contents
The Tornado Project Online	http://www.tornadoobject.com/	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	http://www.nssl.uoknor.edu/	Information about and tracking of severe storms.
Independent Insurance Agents of America IIAA Natural Disaster Risk Map	http://www.iaaa.iix.com/ndcmap.html	A multi-disaster risk map.
Earth Satellite Corporation	http://www.earthsat.com/	Flood risk maps searchable by state.
USDA Forest Service Web	http://www.fs.fed.us/land	Information on forest fires and land management.

Hazard Mitigation Committee Meetings

[illegible]

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET				
Project: South Hadley PDM			Meeting Date: 1/20/16	
Facilitator: Jamie Caplan			Place/Room: South Hadley Town Hall	
Name	Title	Organization	Phone	E-Mail
Sharon Hart	EMD/ Health Director	Town of S. Hadley/ Health Dept.	(413) 315-7307	shart@southhadley.ma.gov
Scott Braodt	CAPT.	SHFD2	(413) 534 5803	SBRAODT@SHFD2.COM
David LaBrie	Police Chief	Town	413-530- 7211	labried@southhadley.police.org
Jim Reedy	Deputy Supt	Town	413 315-0789	jreedy@southhadley.ma.gov
Bruce Mailhot	Facilities Director	School Dept	(413) 875-2234	BMAILHOT@SHSCHOOLS.COM
Richard Harris	Town Planner	Town of South Hadley	413-538 -5017 x 128	rharris@southhadley.ma.gov
TODD CALKINS	South Hadley Dist #2 Water Department	SHFD2	413 433-4979	TCALKINS@SHFD2.COM
Jason Houle	LT.	SHFD1	413 533-7112	jhoule@sndistrict.org
Janice Stone	SHCC Administrator	SH Conservator	413- 538-5017 x 208	jstone@southhadley.ma.gov
Alec Plotnikiewicz	SHFD Intern	SHFD1	(413) 552-8134	alec.plotnikiewicz@maritime.edu
Andy Orr	SHFD Engineer	SHFD2	413 536-1050	aoor@shfd.org
Jeff Cyr	S. Hadley Water Dist	Supt	413- 532-6666	JCYR@sndistrict.org

(nyoung@snschools.com - add to email list

13. Todd Calkins Assistant Chief, SH Fire #2 413-534-5803
tcalkins@shfd2.com

14. Jamie Caplan Consultant

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET				
Project: South Hadley Mitigation Plan			Meeting Date: 1/28/16	
Facilitator: Jamie Caplan			Place/Room: South Hadley Town Hall	
Name	Title	Organization	Phone	E-Mail
Jim Reist	Daw Supt.	Daw	335-0789	jreist@southhadley.ma.gov
MARK Aiken	Water Supt. Dist. 2	SHWD #2	413 210-0995	maiken@comcast.net
David LaBrie	Police Chief	Police	538-8231	labrie@southhadley.police.org
TODD CALKINS	SHWD #2 WATER OPERATOR	SHWD #2	413 532-9210	TCALKINS@SHFD2.COM
Erica Fagunski	Dir. of Curr. + Grants, Fch SHPS	SHPS	538-5259 x 2608	efagunski@shschools.com
Aly W	Engineer	SHED	538-4650	AW@shed.org
Richard Harris	Town Planner	South Hadley	538-5017 Ext 128	rharris@southhadley.ma.gov
Jeff Cyr	S. Hadley Water DL	Superintendent	533-4576	JACYR@SHDISTRICT1.ORG
Sharon Hart	Bolt Emn	South Hadley	315-7307	shart@southhadley.ma.gov
SCOTT BRADY	CAPT.	SHFD2	534-5803	SBRADY@SHFD2.COM

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET				
Project: South Hadley			Meeting Date: 2/3/16	
Facilitator: Jamie Caplan			Place/Room: Town Hall	
Name	Title	Organization	Phone	E-Mail
Andy Orr	Engineer	SHELD	413-538-1050	aoor@sheld.org
Erica Fagnuski- Stark	Dir. of Civ. + Grants	SHPS	538-5057 x2608	efagnuski@shschools.com
Jim Ruddy	DW Supt	DW	538-5033	jruddy@SouthHadley.ma.gov
David LaBrie	Chief of Police	P.D.	538-8431	labried@SouthHadleyPolice.org
Sharon Hart	EMD Boat Dir.	→	315-7307	shart@SouthHadley.ma.gov
Jason Houle	LT.	SHFD 1	533-7112	jhoule@shdistrict1.org
MARK AIKEN	Supt. Dist #2 Water Dept.	SHWD #2	532-9210	MAIKEN@COMCAST.NET
Scott BRADY	CAPTAIN	SHFD 2	534-5803	SBRADY@SHFD2.COM
Richard Harris	Town Planner	Planning Board	413-538-5017 x128	rharris@SouthHadley.ma.gov
Janice Stone	Conservation Administrator	Conservation	538-5017 x208	jstone@SouthHadley.ma.gov
Jeffrey Cyr	Supt.	So Hadley Water DI	413-533-4576	JCyr@shdistrict1.org

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET				
Project: South Hadley		Meeting Date: 2/18/16		
Facilitator: Jamie Caplan		Place/Room: South Hadley Town Hall		
Name	Title	Organization	Phone	E-Mail
Andy Orr	Engineer	SHELD	413-536-1050	aoor@sheld.org
Jim Reidy	DW Supt.	DW	413-538-5033	jreidy@southhadley.ma.gov
MARK AIKEN	Dist 2 Water Supt.	SHWD 2	413-532-9210	MAiken@comcast.net
Richard Harris	Town Planner	Town of South Hadley	413-538-5017 Ext 124	rharris@southhadley.ma.gov
JFCYR	S. Hadley Dist. #1 Water	Superintendent	413-533-4576	JFCYR@shdistrict1.org
David LaBrie	Police Chief	SHPD	538-8131	labrie@southhadley.police.org
Scott Brady	Captain	SHFD2	534-5803	sbrady@shfd2.com
Sharon Hart	Director	Town of S. Hadley	315-7307	shart@southhadley.ma.gov
Jason Houle	LT	SHFD 1	533-7112	Jhoule@shdistrict1.org
Jamie Stone	Conserv. Admn.	Conservation	538-5017 x208	jstone@southhadley.ma.gov

HAZARD MITIGATION COMMITTEE MEETING SIGN-IN SHEET				
Project: South Hadley		Meeting Date: 3/10/16		
Facilitator: Jamie Caplain		Place/Room: Town Hall		
Name	Title	Organization	Phone	E-Mail
Jim Reidy	OPW Supt	SHDAW	538-5033	jreidy@southhadley.ma.gov
MARK AIKEN	Supt	SHWD #2	532-9210	MAIKEN@comcast.net
Jeff Cyr	Supt.	SHWD #1	533-45X	JCYR@SHWD1.ORG
Andy Orr	Eng	SHED	576-7050	aoor@sheld.org
David LaBrie	Chief	Police	538-8231	
Richard D. Harris	Town Planner	Planning	538-5017 Ext 28	rharris@southhadley.ma.gov
Jamie Stone	Conserv	CC	538-5017 x208	jstone@SouthHadley.ma.gov
Scott BRADY	Captain	SHFD2	534-5803	SBRADY@SHFD2.COM

Public Meetings



FEBRUARY 10, 2016 DISASTER PLANNING MEETING

Public Input is Needed

The Town of South Hadley is currently in the process of updating their FEMA Approved Hazard Mitigation Plan. This plan details how the Town may become less vulnerable to disasters caused by natural hazards such as flooding, winter storms and hurricanes. Your participation is important.



February 10, 2016
6:00pm

South Hadley
Town Hall, 116
Main Street in the
Selectboard
Meeting Room

Fires, Floods and
Winter Storms

Share Your Ideas
for Reducing Risk

Preparing a Hazard
Mitigation Plan for
FEMA Approval

FOR MORE INFORMATION

Sharon Hart
Emergency Management
Director/Health Director

413-315-7307
shart@southhadleyma.gov



South Hadley, Massachusetts

MEDIA RELEASE

For Immediate Release
January 26, 2016

Contact: Sharon Hart
413-315-7307

Disaster Planning Public Meeting
February 10, 2016, 6:00pm

This meeting is held in conjunction with the Planning Board Meeting.

The Town of South Hadley is currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and public participation is essential!

Join the Hazard Mitigation Committee at the Planning Board Meeting on February 10, 2016 from 6:00 pm – 7:00 pm to share your ideas for reducing risk and becoming less vulnerable to natural hazards such as floods, hurricanes and winter storms. The meeting will be held at the South Hadley Town Hall, 116 Main Street, Selectboard Meeting Room.

The meeting provides an opportunity for you to share your opinions and participate in the mitigation planning process.

The purpose of the 2016 Hazard Mitigation Plan Update is to identify and assess the community's natural hazard risks and determine how to best minimize and manage those risks. Upon completion, the plan will be presented to the Town of South Hadley for adoption and submitted to Massachusetts Emergency Management Agency (MEMA) and Federal Emergency Management Agency (FEMA) for review and approval. A FEMA approved plan makes the community eligible for federal and state mitigation grant funding.

The Pioneer Valley Planning Commission (PVPC) was awarded a grant from MEMA to develop the 2016 Hazard Mitigation Plan Update; the previous plan was developed in 2007. The PVPC hired Jamie Caplan Consulting LLC to work with them and the Town to develop the 2016 Hazard Mitigation Plan Update.

If you have any questions regarding the meeting, or would like to learn about more ways you can participate in the development of the Hazard Mitigation Plan, please contact Sharon Hart, Emergency Management Director/Health Director, South Hadley, MA at 413-315-7307 or shart@southhadleyma.gov.

PUBLIC MEETING SIGN-IN SHEET				
Project: <u>South Hadley</u>			Meeting Date: <u>2/10/16</u>	
Facilitator:			Place/Room:	
Name	Title	Organization	Phone	E-Mail
Andy Orr	Engineer	SHELD	413-536-1050	aoor@sheld.org
Jim Rony	Drw Supt	SHDPW	538-5033	jrony@southhadley.ma.gov
MARK Aiken	Dist-2 Water Supt.	SHND #2 Water	532-9210	MAIKEN@comcast.net
David LaBrie	Police Chief	Police	538-8231	labrie@southhadleypolice.org
Jason Houk	LT Fire Prevention	SHFD 1	538-7112	jhouk@shadistrict1.org
Michael Sullivan	Town Admin	TOSH	413-538-6017 ext 1156	msullivan@southhadley.ma.gov
Sharon Hart	EMD/ BoH Director	BoH	413-815-7307	shart@southhadley.ma.gov
John Howland			538-5973	JHOWLAND@MT HILL YOUTH COUNCIL
Jeff Cyr	Supt.	So Hadley Water Dist. #1	538-4576	jcyr@shoistinct1.org
Jamie Stone	Conservation Director Administrator	Conservation	538-5017 X208	jstone@southhadley.ma.gov
Scott Brady	CAPTAIN	SHFD 2	538-5803	sbrady@shfd2.com
Spun Young			532-3921	spunyoung@mt-hill-youth-council.org

PUBLIC MEETING SIGN-IN SHEET				
Project: <u>SOUTH HADLEY</u>			Meeting Date: <u>2/10/16</u>	
Facilitator:			Place/Room:	
Name	Title	Organization	Phone	E-Mail
CHRIS TAIT	P.E.	Doucet & Assoc.	413 517 0133	ctait@doucetengineers.com
Charles B. B. B.	Building	South Hadley		
Michelle Theroux	CEO	BHMA	413-540-9220	mtheroux@barkshill.org
DEREK NOBLE	PRINCIPAL	STEFFAN BROADLEY ARCHITECTS	860 657 1923	DEREK@STEFFAN.COM
Melissa O'Brien		P.B. GARD	413-536-6338	xdoisneau@yahoo.com
Joan Rosner		Pl. Board	413-536-5669	joanrosner@comcast.net
MARK CANNARA		Planning Bd		MARKCANNARA@GMAIL.COM
Helen Fantini		Planning Bd	(413) 532-2310	hfantini@hotmail.com
Ruth J. Hays	Town Planner	Town of South Hadley	413-538-5617 Ext 128	rhayes@southhadley.ma.gov



MARCH 8, 2016 DISASTER PLANNING MEETING

Public Input is Needed

The Town of South Hadley is currently in the process of updating their FEMA Approved Hazard Mitigation Plan. This plan details how the Town may become less vulnerable to disasters caused by natural hazards such as flooding, winter storms and hurricanes. Your participation is important.



March 8, 2016

7:00pm



South Hadley
Town Hall, 116
Main Street in the
Selectboard
Meeting Room



Fires, Floods and
Winter Storms



Share Your Ideas
for Reducing Risk
Preparing a Hazard
Mitigation Plan for
FEMA Approval

FOR MORE INFORMATION

Sharon Hart
Emergency Management
Director/Health Director

413-315-7307
shart@southhadleyma.gov



South Hadley, Massachusetts

MEDIA RELEASE

For Immediate Release
February 19, 2016

Contact: Sharon Hart
413-315-7307

Disaster Planning Public Meeting
March 8, 2016, 7:00pm

This meeting is held in conjunction with the Selectboard Meeting.

The Town of South Hadley is currently engaged in a planning process to become less vulnerable to disasters caused by natural hazards, and public participation is essential!

Join the Hazard Mitigation Committee at the Planning Board Meeting on March 8, 2016 from 7:00 pm – 8:00 pm to share your ideas for reducing risk and becoming less vulnerable to natural hazards such as floods, hurricanes and winter storms. The meeting will be held at the South Hadley Town Hall, 116 Main Street, Selectboard Meeting Room.

The meeting provides an opportunity for you to share your opinions and participate in the mitigation planning process.

The purpose of the 2016 Hazard Mitigation Plan Update is to identify and assess the community's natural hazard risks and determine how to best minimize and manage those risks. Upon completion, the plan will be presented to the Town of South Hadley for adoption and submitted to Massachusetts Emergency Management Agency (MEMA) and Federal Emergency Management Agency (FEMA) for review and approval. A FEMA approved plan makes the community eligible for federal and state mitigation grant funding.

The Pioneer Valley Planning Commission (PVPC) was awarded a grant from MEMA to develop the 2016 Hazard Mitigation Plan Update; the previous plan was developed in 2007. The PVPC hired Jamie Caplan Consulting LLC to work with them and the Town to develop the 2016 Hazard Mitigation Plan Update.

If you have any questions regarding the meeting, or would like to learn about more ways you can participate in the development of the Hazard Mitigation Plan, please contact Sharon Hart, Emergency Management Director/Health Director, South Hadley, MA at 413-315-7307 or shart@southhadleyma.gov.

PUBLIC MEETING SIGN-IN SHEET	
Project: <u>South Hadley</u>	Meeting Date: <u>3/8/16</u>
Facilitator: <u>Jamie Caplan</u>	Place/Room: <u>Town Hall</u>

Name	Title	Organization	Phone	E-Mail
<u>Jack Houli</u>	<u>LT.</u>	<u>SHFD 1</u>	<u>533-7112</u>	<u>Jhouli@shelistrict1.org</u>
<u>MARK Aiken</u>	<u>Supt.</u>	<u>SHWD #2</u>	<u>532-9210</u>	<u>MAiken@comcast.net</u>
<u>Laura Knight</u>	<u>Administrative Secretary</u>	<u>SB/Town Admin.</u>	<u>538-5017</u>	<u>LKnight@SouthHadley.ma.gov</u>
<u>Scott Brady</u>	<u>Captain</u>	<u>SHFD 2</u>	<u>534-5803</u>	<u>SBRADY@SHFD2.COM</u>
<u>Sharon Hart</u>	<u>EMD Health Director</u>	<u>SH-BOH</u>	<u>315-7307 538-5013</u>	<u>shart@SouthHadley.ma.gov</u>
<u>GREG DUBREUIL</u>	<u>RESIDENT</u>	<u>N/A</u>	<u>532-2050</u>	<u>gsdubac@msn.com</u>
<u>VERN BLODGETT</u>	<u>RESIDENT</u>	<u>N/A</u>	<u>532-0569</u>	<u>V4B@comcast.net</u>
<u>BARBARA MAGNUSON</u>	<u>Resident</u>	<u>South Hadley Democratic Town Ctr</u>	<u>(413) 532-0569</u>	<u>Barbara.MAGNUSON@comcast.net</u>
<u>Sandra Zieminski</u>	<u>Taxpayer</u>	<u>Resident South Hadley, N/A</u>	<u>(413) 536-2448</u>	
<u>A. Tosia BARA</u>	<u>Resident</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
<u>TOM CAMP</u>	<u>RESIDENT</u>	<u>N/A</u>	<u>536-4113</u>	<u>KATEC20@AOL.COM</u>
<u>Andy Ous</u>	<u>Engineer</u>	<u>SHED</u>	<u>536-1050</u>	<u>aos@sheld.org</u>

Jim Rony Dan Supr SHDAN 538-5033 jrony@SouthHadley.ma.gov
 David LaBoie Police Chief Police 538-5031 laboie@SouthHadleyPolice.org

PUBLIC MEETING SIGN-IN SHEET				
Project: South Hadley		Meeting Date: 3/8/16		
Facilitator: Jamie Caplan		Place/Room: Town Hall		
Name	Title	Organization	Phone	E-Mail
Rich Young	resident			
Diane Kofoske	Resident			
Cheryl Kofoske	Resident			
Kathy Sullivan	Resident			
Chris Clark	RESIDENT			
Joanna Brown	Resident			
Michael Sullivan	TIA			
Bowie C. Forlien	SECTBOARD			
FRANZ DEJONH	SECTBOARD			
John Hine	Select Board			
Sarah Etelman	Selectboard			

APPENDIX C – SUBDIVISION REGULATIONS AND ZONING BYLAW EXCERPTS

Flooding

Subdivision Rules and Regulations

Section 5.03 [Definitive Plan] Contents [in part]

The [Definitive Plan](#) shall contain the following information:

9. Significant site features such as existing stone walls, fences, buildings, wetlands, flood plains, large trees and rock outcroppings.

Form WPC-P-1 Development Impact Statement [in part]

A Development Impact Statement (DIS) is a documented, written analysis of a proposed development which provides the Planning Board and Town Officials with information necessary for plan review. It is a developer's responsibility to prepare and document the DIS in sufficient detail to permit an adequate evaluation by the Planning Board; however, additional data may be requested in writing by the Board. It is necessary to respond to all sections of the DIS form except when a written exemption is granted by the Planning Board. The applicant is urged to contact the Office of the Town Planner in the process of completing a Development Impact Statement.

III. SUPPORT SYSTEMS.

2. Private - Discuss the types of wells proposed for the project, means for providing fire supply, and any special problems which might arise.

b. Sewage Disposal

1. Public - Discuss the project's sewage disposal system, including projected flow, size of pumping stations including auxiliary power, and any special problems such as check valves, etc. which must be dealt with, and the effects on the waste water treatment facility.

c. Storm Drainage - Discuss the storm drainage system including the projected flow from 10 year and a 100 year storm, name of the receptor stream, and any flow constriction between the site and the receptor stream.

f. Fire Protection - Discuss the type and capacity of fuel storage facilities, location of storage areas for hazardous substances, special requirements, and distance to fire station.

IV. NATURAL CONDITIONS - Describe briefly the following natural conditions:

a. Topography - Indicate datum, source, date, slopes greater than 25%

- d. Surficial geology
- i. Flood prone areas
- f. [Aquifer](#) recharge areas
- k. Unique wildlife habitats
- g. Wetlands
- l. Unique flora
- h. Watercourses

VI. ENVIRONMENTAL IMPACT

- c. Measures taken to maximize ground water recharge
- e. Measures taken to prevent erosion and sedimentation

VII. PLANS - Describe how the project relates to the following guidelines.

- a. Master Plan
- b. Open Space Plan
- c. Regional plans prepared by the Lower Pioneer Valley Regional Planning Commission

8.09 Utilities

1. General Standards

The installation of utilities and underground structures shall conform to the following general standards:

- a. All public and private sewers, surface water drains, water and gas pipes, electric, telephone and cable T.V. lines, together with their appropriate underground structures, within the street right-of-way, shall be placed underground.
- i. Private, on-site water supply wells shall be located a minimum of one hundred (100) feet from a leaching field, seepage pit or cesspool; ten (10) feet from a sewer line; and fifty (50) feet from a septic tank.

2. Drainage System

- a. The storm drainage system shall be so designed to intercept storm water runoff from the entire portion of the drainage basin that drains to or across the proposed subdivision, and provisions shall be made for proper and adequate storm lines, structures, and channels to accommodate up stream properties as well as affording protection from flooding and erosion to adjacent and down stream properties.
- b. In determining quantities of storm water for system design, the rational method should be used, unless another method is shown to be more appropriate in specific

cases, but in, any event, the system should be designed for a minimum of twenty-five (25) year storm frequency.

c. Discharge of storm water shall be either into an existing, adequate storm system or the nearest natural water course. Where necessary, the developer shall obtain and convey to the Town drainage easements on adjacent properties, and be responsible for installation of pipe and structures or channels at his expense.

d. Storm water shall not be permitted to cross over the roadway on the surface, and must be piped underneath the roadway.

f. Catchbasins shall be located on both sides of the roadway at intervals of not more than three hundred (300) feet on continuous grades, and at low points and sags in the roadway and near the corners of the roadway at intersecting streets.

g. Maximum distance for surface runoff to flow upon the road surfaces shall be three-hundred (300) feet.

i. Where storm water discharges into an open stream or channel, provisions shall be made for proper stabilization of the stream channel.

j. As construction progresses, unforeseen groundwater conditions may be encountered which require additional subdrains, curtain drains and/or footing drains. These conditions include potential problems if construction is in progress at a time of low water table or other dry conditions. The Board, acting on the advice of the Department of Public Works, reserves the right to require appropriate systems, including stubs, to accommodate the problems.

l. Through every phase of construction no surface run-off will drain onto the abutting public way or abutting private property.

3. Sanitary Sewer System

a. Wherever, in the opinion of the Planning Board, the public sewerage system is reasonably accessible and where connection to it is feasible, the applicant shall properly connect all lots in the subdivision to the public sewerage system.

4. Water Systems

a. Where available and feasible, all lots in a subdivision shall connect to the appropriate water service system: Water Department, Fire District Nos. 1 and 2.

5. Electrical, Telephone and other Wires

a. All electrical, telephone, fire alarm, cable T.V. and other wires and cables shall be installed underground, unless in the opinion of the Planning Board and the appropriate utility company, such installation is impractical or not in the best interest of the Town.

Installation of the underground electrical distribution system shall be in accordance with the specifications and regulations of the South Hadley Electric Light Department.

Section 7.02 Easements [in part]

2. Where a subdivision is traversed by a water course, drainage way, channel or stream, the Planning Board may require that there be provided a storm water easement or drainage right-of-way of adequate width to conform substantially to the lines of such water course, drainage way, channel or stream, and to provide for construction or other necessary purposes.

5.04 Additional Subdivision Requirements

3. Wetlands Protection Act

In accordance with Chapter 131, Section 40 of the General Laws, no person shall remove, fill, dredge or alter any bank, beach, dune, flat, marsh, meadow or swamp bordering on any existing creek, river, stream, pond, lake or any land under said waters or subject to flooding without filing written notice of intention to perform said work with the local Conservation Commission and State Departments of Natural Resources and Public Works. In order to determine if certain proposed subdivisions, or parts thereof, are subject to the provisions of the Wetlands Protection Act, the Planning Board will, where it deems necessary, submit a copy of the Definitive Plan or Plan for More Than One Building for Dwelling Purposes Per Lot to the Conservation Commission. The Conservation Commission shall, to the extent practicable, file a report with the Planning Board not later than forty-five (45) days after receipt of the plan stating that the proposed plan:

- 1) is not subject to the provisions of the Wetlands Protection Act, or
- 2) the Wetlands Protection Act applies to certain designated areas. In the event the Conservation Commission indicates that the plan shall be governed by said Act, the Planning [Board](#) shall include in its decision for approval, a condition that the [applicant](#) shall obtain approval from the Conservation Commission prior to any construction activity in the affected areas.

7.03 Open Spaces and Protection of Natural Features

Before approval of a plan, the Planning Board may also, in proper cases, require the plan to show a park or parks suitably located for playground or recreation purposes or for providing light and air. The park or parks shall not be unreasonable in area in relation to the land being subdivided and to the prospective uses of such land. The Planning Board may by appropriate endorsement on the plan require that no building be erected upon such park or parks for a period of not more than three (3) years without its approval. Due regard shall be shown for all natural features such as large trees, water courses,

scenic points, historic spots and similar community assets, which if preserved, will add to the attractiveness and value of the subdivision and the Town.

7.04 Compliance with Zoning By-Law

No plan of a subdivision shall be approved unless all of the lots shown on the plan comply with the Zoning By-law [note, this includes all floodplain regulations].

South Hadley Zoning Bylaws

The Town of South Hadley has established a set of bylaws designed in part to promote “the health, safety, convenience, amenity and general welfare of the inhabitants of the Town of South Hadley, through encouraging the most appropriate [use](#) of land, as authorized by Chapter 40A of the General Laws, Sections 1 to 17 inclusive. In pursuit of this purpose, the objectives of this By-Law include the following: to lessen congestion in the streets; to conserve health; to secure safety from fire, flood, panic and other dangers; to provide adequate light and air; to prevent overcrowding of land, to avoid undue concentration of population; to facilitate the adequate provision of transportation, water supply, drainage, sewerage, schools, parks, open space and other public requirements; to conserve the value of land and buildings, including the conservation of natural resources and the prevention of blight and pollution of the environment; to encourage the most appropriate [use](#) of land throughout the Town by considering the recommendations of the master plan; and to preserve and increase amenities by the promulgation of regulations to fulfill said objectives.” The Zoning By-Laws include several provisions that mitigate the potential for flooding, including:

Section 12 Site Plan Review

The purpose of site plan review is to ensure that new development is designed in a manner which reasonably protects visual and environmental qualities and property values of the Town, to assure adequate drainage of surface water, and safe vehicular access, and is consistent with the Zoning By-Laws and [Building](#) Regulations.

B. Projects Requiring Site Plan Review

1. the construction or exterior expansion of commercial structures;
2. the construction or exterior expansion of industrial structures;
3. any other [use](#) specified in Section 5(D), Schedule of [Use](#) Regulations, which indicates Site Plan Review is required unless the [use](#) is locating in an existing [structure](#) and no additions to the [structure](#) is to be undertaken and the Town Planner determines no additional parking will be required to conform to the Parking Requirements outlined in Section 8 of the Zoning By-Law. No special permit or [building](#) permit shall be applied for or issued for any of the above uses unless a site plan has been endorsed by the Planning [Board](#), after consultation with other boards, including but not limited to the following: [Building](#) Commissioner, [Board](#) of Health, Electric Light Department, Water Department, Conservation Commission, DPW Superintendent, Fire Department, Tree Warden and Police Department.

E. Site Plan Review Criteria

The Planning Board shall review the site plan and supporting data taking into consideration the reasonable fulfillment of the following objectives:

1. Integrates the development into the existing terrain and surrounding landscape.
3. Provides for building sites, which to the extent feasible,
 - (a) minimize use of wetlands, steep slopes, floodplains, hilltops;
 - (d) minimize tree, vegetation and soil removal and grade changes;
 - (e) maximize open space retention; and
6. Provides for adequate water supply and waste disposal systems. For structures to be served by on-site waste disposal systems, the applicant shall submit a system design prepared by a Commonwealth of Massachusetts licensed sanitary engineer and approved by the Board of Health.
7. Provides for adequate measures to prevent pollution of surface or ground water, to minimize erosion and sedimentation, and to prevent changes in ground water levels, increased run-off and potential for flooding.
8. Mitigates adverse impacts on the town's services and infrastructure.
9. Requires that electric, telephone, cable tv, and other utilities be underground where physically and environmentally feasible.

L. Flood Plain Regulations

1. Purposes. These flood plain regulations are intended to provide standards for the use of those lands deemed subject to seasonal or periodic flooding, and are enacted for the following purposes:
 - a. To eliminate potential dangers to the health and safety of occupants of said lands, or of the public generally;
 - b. To prevent loss and damage to property, and relieve the burden from the public of costs resulting from the unwise use of said lands;. and
 - c. To retain the natural storage capacity of the water-shed, and assure the continuation of the natural flow pattern of water courses within the Town, in order to avoid encroachment on the floodplain which would increase the extent and severity of flooding up- and downstream.
2. Flood Plain District. [Establishment of District]

The Flood Plain District is herein established as an overlay district. The Flood Plain District includes all special flood hazard areas designated as Zone A, A1-30 on the South Hadley Flood Insurance Rate Maps (FIRM), and all areas within the limits of the 100 year flood boundary indicated on the Flood Boundary and Floodway map, said maps dated August 15, 1979 having been prepared by the U.S. Dept. of Housing and Urban Development (HUD) and having been placed on file with the Town Clerk, Planning Board and Building Commissioner. These maps as well as the accompanying South Hadley Flood Insurance Study are incorporated herein by reference. The above-described Flood Plain District is hereinafter also referred to as the flood plain. The floodway is hereby defined to include: (1) the area shown as within the floodway on the above-referenced maps, and (2) the area within the flood plain which lies ten (10) feet or more below the elevation of the flood plain limits. The boundaries of the floodway shall be determined by the limits of the more extensive of the aforesaid areas. Within Zone A, where the base flood elevation is not provided on the FIRM, the applicant for any building permit shall obtain any existing base flood elevation data and it shall be reviewed by the Building Commissioner for its reasonable utilization toward meeting the elevation or floodproofing requirements, as appropriate, of this Section and of the State Building Code.

3. Permitted Uses. [Regulations]

Within the flood plain but outside of the floodway, all uses as permitted in the applicable zoning district are allowed, provided that the lowest floor, including basement or cellar, of any building or structure is constructed at an elevation of at least one (1) foot above the elevation of the flood plain limits as defined in the above-referenced maps. Within the floodway, only uses not involving a building, such as farming, forest management, nurseries, conservation areas, parks, playgrounds, boat landing ramps, public utility wires and pipe lines, and vehicular parking areas are permitted. Open storage of materials or equipment subject to flotation or washing away, such as lumber storage, is not a permitted use nor is the storage of inflammable liquids such as petroleum. The addition or filling of soils, gravel, rocks, waste materials or other substances to raise the elevation or contours of land in the floodway is prohibited.

4. Exceptions.

The Planning Board, acting as the special permit granting authority, may grant a special permit for the construction of non- residential structures or buildings in the flood plain but not in the floodway, provided that the following conditions are satisfied:

- a. The building or structure is a permitted use in the applicable zoning district; and
- b. Such building or structure shall be designed and constructed to meet the structural design requirements for flood proofing as specified in Section 748.2 of the Massachusetts State Building Code, as amended, up to an elevation not less than two (2) feet above the elevation of the flood plain limits. Working plans and specifications bearing the seal of a registered architect or engineer shall be submitted to the Planning Board and the Building Commissioner to verify that the

proposed construction will withstand flood conditions as set forth in said State Building Code. The Planning Board may attach conditions to such special permit to protect the health and safety of the occupants of the premises, to prevent loss and damage to the property, and to insure that construction and improvements on the land will not result in flood channel impoundments creating hazardous conditions for those properties upstream from that of the applicant.

7. Compliance with Other Regulations. [Additional Protection]

All development and use of land in the Flood Plain District, including structural and non-structural activities, whether permitted by right, Special Permit or Site Plan Review (noted as Y, SP, SPR respectively in Subsection 5(D) of the Zoning By-Law) must be in compliance with Chapter 131, Section 40 of the Massachusetts General Laws and with other state and local regulations including but not limited to, the following:

- a. Applicable section(s) of the Massachusetts State Building Code which addresses floodplain and coastal high hazard areas;
- b. Department of Environmental Protection (DEP) regulations regarding:
 - Wetlands Protection
 - Inland Wetlands Protection
 - Subsurface Disposal of Sanitary Sewage

Variances granted by the Town of South Hadley under Chapter 40A, MGL or the Town's Zoning By-Law do not convey a grant of a variance from State Regulations. Accordingly, any variances from the provisions and requirements of the State Regulations referenced in paragraphs 7a or 7b above may only be granted in accordance with the required variance procedures of the applicable State regulations.

[Impact on Subdivision Regulations]

- b. All Preliminary and Definitive Subdivision Plan and Site Plan proposals must be designed, and are to be reviewed, to assure that:
 - 1.) development and use proposals minimize flood damage; and
 - 2.) all public utilities and facilities are located and constructed to minimize or eliminate flood damage; and,
 - 3.) adequate drainage is provided to reduce exposures to flood hazards.

N. Water Supply Protection District [in part, filtered according to impact on water flow and pervious surfaces]:

1. Purpose: To promote the health, safety and welfare of the community by protecting and preserving the surface and groundwater resources of the Town and the region from any use of land or buildings which may reduce the quality and quantity of its water resources.

3. District Delineation.

The Water Supply Protection District is herein established to include all lands within the Town of South Hadley, lying within the primary and secondary recharge areas of groundwater aquifers and watershed areas of reservoirs which now or may in the future provide public water supply. The map entitled "South Hadley Water Protection Area" on file with the Town Clerk, delineates the boundaries of the district. Where the bounds delineated are in doubt or in dispute, the burden of proof shall be upon the owner(s) of the land in question to show where they should properly be located.

4. [The following uses are permitted in this district, provided there are no conflicts with sections 7N5-7N8]:

a. Single family residences, provided that where not serviced by public sewer, lot size shall be 10,000 square feet of lot area per bedroom or 40,000 square feet, whichever is greater. For cluster development, minimum lot size may be calculated on a net density for an entire development, which includes individual lots and common open space of varying size. Where serviced by public sewerage, minimum residential lot size shall comply with the residential requirement of the underlying district.

b. Residential accessory uses, including garages, driveways, private roads, utility rights of way, and on-site wastewater disposal systems.

c. Agricultural uses such as farming, grazing and horticulture.

d. Forestry and nursery uses.

e. Outdoor recreational uses, including fishing, boating and play areas.

f. Conservation of water, plants and wildlife.

g. Wildlife management areas.

h. Excavation for earth removal, provided that the requirements of Section 7N6 and 8E are met, and an earth removal permit is granted by the Building Commissioner.

i. Wireless Communications Facilities when approved pursuant to Section 5(D) and Section 7(S) subject to the conditions of the Planning Board as set forth in the Special Permit decision.

6. Restricted Uses

The following uses are restricted within the Water Supply Protection District:

- a. Excavation for removal of earth, loam, sand, gravel and other soils or mineral substances shall not extend closer than five (5) feet above the historical high groundwater table (as determined from on-site monitoring wells and historical water table fluctuation data compiled by the United States Geological survey, whichever is higher. A monitoring well shall be installed by the property owner to verify groundwater elevations. This section shall not apply to excavations incidental to permitted uses, including but not limited to providing for the installation or maintenance of structural foundations, freshwater ponds, utility conduits or on-site sewage disposal.

2. Upon completion of earth removal operations, all altered areas shall be restored with topsoil and vegetative plantings. All fine materials, such as clays and silts, removed as part of the earth removal operation and leftover as by-products, shall be disposed of off-site to prevent damage to aquifer recharge characteristics.

7. Drainage

For commercial and industrial uses, to the extent feasible, run-off from impervious surfaces shall be recharged on the site by being diverted toward areas covered with vegetation for surface infiltration. Such run-off shall not be discharged directly to rivers, streams or other surface water bodies. Dry wells shall be used only where other methods are infeasible, and shall be preceded by oil, grease and sediment traps to facilitate removal of contamination.

8. Special Permit Uses

a. Uses Allowed by Special Permit

1. Commercial, industrial, governmental or educational uses which are allowed in the underlying district, and which are not prohibited in Section 7-N-5.
2. Any enlargement, intensification, change of use or alteration of an existing commercial or industrial use;
3. The rendering impervious of more than 15%, or 2,500 square feet of any lot, provided that a system for artificial recharge of precipitation to groundwater is developed, which shall not result in degradation of groundwater. (See (7) above).

[Special Permit Granting Authority and Site Engineering]

1. The Special Permit Granting Authority shall follow all special permit procedures contained in Section 9 of this By-Law. In addition the Special Permit Granting Authority shall distribute copies of all application materials to the Board of Health, the Conservation Commission and the Water Commissioners, each of which shall review the

application, and following a vote, shall submit recommendations and comments to the Special Permit Granting Authority. Failure of boards to make recommendations within 35 days of distribution of the applications shall be deemed to be lack of opposition.

3. In no way, during construction or thereafter, adversely affect the existing or potential quality or quantity of water that is available in the Water Supply Protection District, and;
4. Be designed to avoid substantial disturbance of the soils, topography, drainage, vegetation and other water-related natural characteristics of the site to be developed.

J. Flexible Development [in pertinent part]

Purpose.

- b. Preservation of natural open space for its scenic qualities and for its agricultural, environmental, forestry, and recreational uses.
- c. Protection and enhancement of property values.
- d. Housing located sensitive to a site's environmental assets and constraints.

4. Design Process. Flexible Development is a unique approach in that it permits wide flexibility in defining the dimensional standards and density allowed for the residential development with a focus on open space and cultural space preservation. The design process outlined below is essential to achieving the purposes of the Flexible Development provisions of the Zoning By-Law. Accordingly, each development plan shall be based on following the multi-step design process outlined below.

c. Designation of preservation areas. The third step is to identify the common open space and cultural areas of the site to be preserved or enhanced. These areas should include the most important and unique resources and scenic view elements. To the extent appropriate, areas that serve to extend neighborhood and community open space networks should be included in these areas.

d. Delineation of development features. The fourth step is to delineate the locations/areas to be used for the development features, including, but not limited to, building sites, streets, parking areas; paths, utility infrastructure corridors, and drainage basins. This process should reflect an integrated community which is compatible with surrounding and historical development patterns.

5. Procedures. c. Supplemental Contents. In addition to the requirements specified in Section 9 and Appendix E of the Zoning By-Law, applications for a Flexible Development must include the following information:

- i. Boundaries of areas subject to regulation by the South Hadley Conservation Commission.

9. [Density Bonuses and Required Open Space]:

a. Additional open space. For each additional ten percent of the site (over and above the required 30 percent) set aside as common open space, a density bonus of one additional unit may be awarded; provided that this density bonus shall not exceed 50 % of the base number of dwelling units. Vegetated areas required as buffer areas between the subject development and adjoining properties or roadways shall not qualify for this additional open space density bonus.

10. Site Design Standards

d. Water Supply Protection District.

The Planning Board may grant a Special Permit to allow a Flexible Development in the Water Supply Protection District where the following conditions are satisfied.

Severe Snowstorms / Severe Ice Storms

Subdivision Rules and Regulations

Section 2370 Alternate Procedures Plan – Common Private Ways

Common Private Ways shall have: a staging area of at least 40 feet in length from the street line, with a minimum width of 20 feet pavement in accordance with the Subdivision Regulations, and sloped not more than 4% grade for the 40 feet it extends from the street line.

Section 7.0 Design Standards

3. Grades

The minimum grades of all streets and ways shall be:

a. Type "A" Subdivisions

- 1) No grade shall be greater than nine (9) percent.
- 2) No grade shall be less than one-half of one (0.5) percent.

b. Type "B" Subdivisions

- 1) No grade shall be greater than six (6) percent.
- 2) No grade shall be less than one-half of one (0.5) percent.

8.09 Utilities

1. General Standards

The installation of utilities and underground structures shall conform to the following general standards:

- a. All public and private sewers, surface water drains, water and gas pipes, electric, telephone and cable T.V. lines, together with their appropriate underground structures, within the street right-of-way, shall be placed underground.

Hurricanes

Zoning Bylaws

S. Wireless Communications Zoning [in part]:

Purpose:

- a. Provide reasonable, non-discriminatory standards and procedures under which adequate and necessary Wireless Communications - Facilities may be permitted, developed and maintained; and,
- b. Ensure that permitting Wireless Communications Facilities will be in harmony with the Zoning By-Law and the character and appearance of the surrounding community; and,
- c. Protect the community's scenic, historic, and environmental resources; and,
- d. Locate Wireless Communications Facilities such that their location does not have negative impacts (such as, but not limited to visual blight, attractive nuisance, noise and falling objects) on the general safety, welfare and quality of life of the community; and,
- e. Encourage Co-Location of Wireless Communications Facilities to the maximum extent possible; and,
- f. Provide for the development of free standing Wireless Communications Towers to the extent necessary to enable the Providers of Wireless Communications Services to provide adequate coverage throughout the community, yet limit the number of such Towers to the minimum amount needed for such services....

5. Location Criteria

- a. Existing Towers and Alternate Tower Structures: To the extent feasible, Antennas are to be located on existing Towers and existing Alternate Tower Structures.
- b. Spacing: No Wireless Communications Tower shall be located closer than one mile of any other such Tower, except as provided below. The spacing distance shall be measured as the shortest distance between two points as if on a flat topography.
- c. Historic and Residential Properties: No Wireless Communications Tower shall be located closer than three-hundred feet (300') to any property (1) listed on either the State or National Register of Historic Places or (2) developed as part of a residential subdivision for which a Definitive Plan was approved by the South Hadley Planning Board, except as may be waived by the Planning Board...

